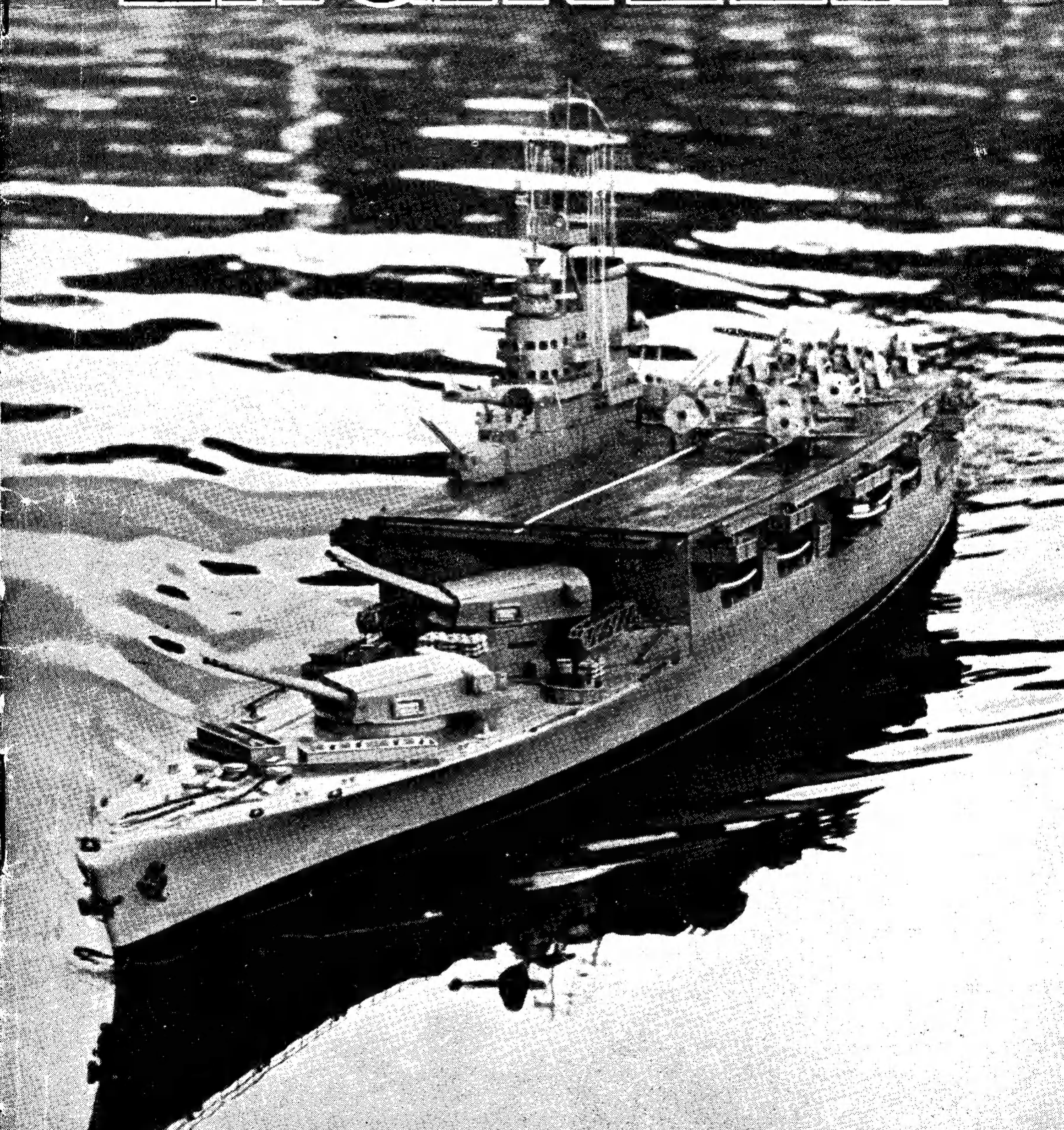
THE MODEL ENGINEER



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The MODEL ENGINEER

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13TH APRIL 1950 VOL. 102 NO. 2551

SMOKE RINGS

Our Cover Picture

● THIS WEEK our photograph is of a very fine model of the French aircraft carrier *Arromanches*, sailing under her own power on the lake in the Luxembourg Park, Paris, in connection with a festival organised by the French Navy. This ship has a shorter flight deck than is usual in the latest ships of this type and the graceful lines of the hull are more in evidence. From the photograph it seems that the flight deck can be extended forward over the gun turrets, and this would appear to be necessary for any reasonable take-off. The model, which is over 6 ft. in length, has quadruple screws and so far as we can ascertain the motive power is electric. A considerable amount of detail has been included and the general atmosphere of a ship of this type has been captured. Although the model seems to be doing a fair speed, there is practically no disturbance along the side of the ship, showing both good hull form and a high degree of finish on its surface.

From a "Lone Hand"

● AMONG A number of interesting letters we receive from overseas readers, there are often some from people who describe themselves as "lone hands"; in fact, it is often the case that these solitary readers are such through sheer force of circumstances. We are always glad to hear from them, and some time ago we published a note in this column definitely inviting lonely readers to write to us.

A recent and most interesting letter has arrived from Mr. A. Thomas, who, after a seventeen-months' sojourn in the Cocos Keeling Islands, is now stationed in the Cape Verde Islands, where the British community numbers thirty-nine. He writes: "Although I have been interested in model making since my parents allowed me to own a knife, I am a newcomer to the family of readers of THE MODEL ENGINEER.

"Lo and behold, on arrival on the island I found another 'lone hand' (since left) and through him met THE MODEL ENGINEER. Now I am a regular reader, obtaining my copy via my father who posts it to me—thereby making the arrival of mail even more interesting.

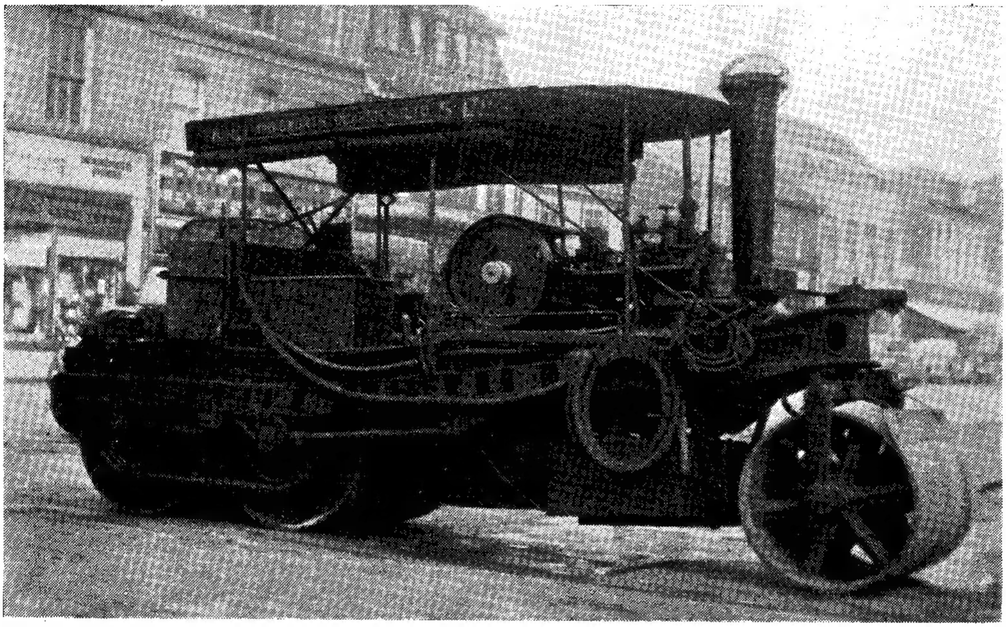
"Now I would be grateful if you would answer a query. I have found the instructions 'drill with a Slocomb.' Does this, please, mean a centre drill, and if so, why pick upon one of the many firms that manufacture such drills, and label the drill accordingly?

"As for my models. The latest off the production line is a ½ in. to 1 ft. model of an 18 ft. sailing boat. As fishing was the main sport at Cocos, the model is designed to be what I consider the perfect fishing boat for coral islands

(one of the main points being a means of keeping my cigarettes dry !). It was constructed so that I could teach my wife the rudiments of sailing, and at the same time make an interesting table centre for dinner parties, consequently it is complete with all accessories, including harpoon, boathook, baling can, parang (Malay bush-knife), etc. Next off the line will be a means of locomotion, powered by clockwork, for my son, who will have reached the crawling-walking stage by the time it is completed—I hope. After that, it is my earnest wish to make a steam engine, which means—as it will be my first effort in that line—that I will have to delve through THE MODEL ENGINEER and discover the intricacies of slide-valves, etc.

"In conclusion, may I say that I think that, in this world of high prices, your magazine is one of the few things where value is given for money. Nay, more than value. May its shadow never grow less !"

This is one of those letters which have such a tonic effect upon those of us who are responsible for keeping THE MODEL ENGINEER going. We never know where the results of our efforts will next provoke a friendly response ; it happens so very frequently now, and we are ever grateful for it.



Another Unusual Steam Roller

● MR. G. T. KRUSE, of Harpenden, has sent us the photograph reproduced on this page. It depicts a road roller which was on surfacing work in St. Albans during February last.

This quaint-looking machine has the usual locked, worm-geared steering connected to a tiller over the front roller ; the crankshaft and flywheel have a semicircular guard-plate over them, and the drive is from a countershaft below the crankshaft to the leading driving roller by means of a chain on the near-side. The two driving rollers are coupled by a similar chain on the off-side, as seen in the photograph. Rods are fitted to maintain the correct tension in the chains.

The firebox is circular in section, and owing to the height of the footplate being so near that of the boiler, the fire-door must be fairly close to the top of the firebox.

There is, apparently, no maker's name to be found, but the long plate on the valance of the awning reads : "Wirksworth Quarries Ltd." Altogether, this is a very choice specimen, and we wonder how many more are to be found at work today.

A New American Periodical

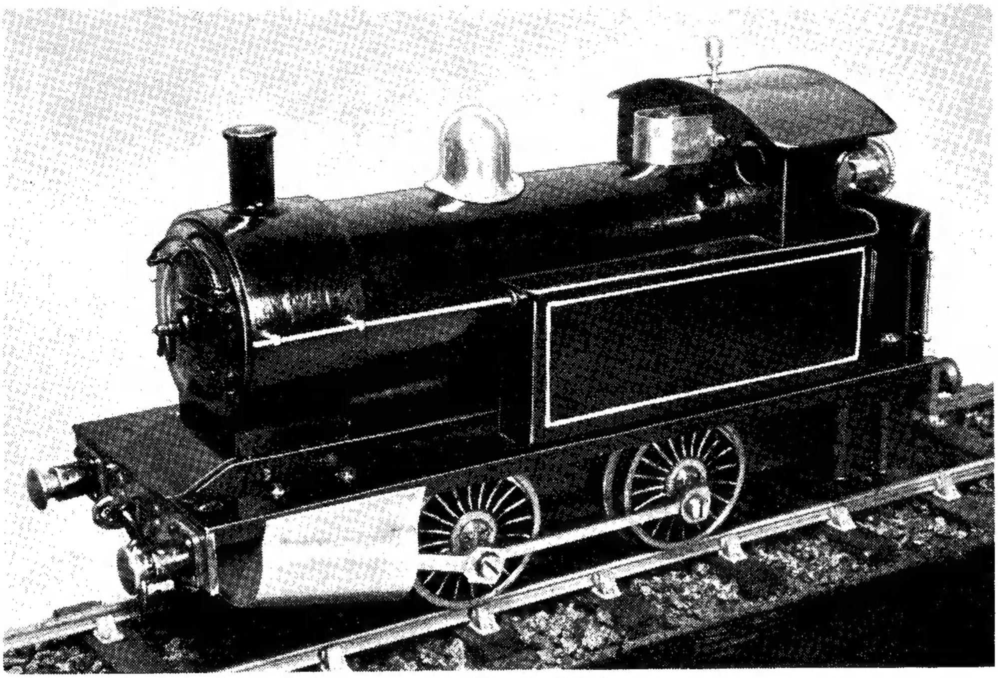
● WE HAVE received a copy of No. 1 of a new little periodical called *The Live-Steamer*, published by Mr. George D. Murray, 189, School Street, Manchester, Connecticut, U.S.A., to supply the long-felt need of a small magazine dealing with the building of small live-steam locomotives and equipment. It is a bright little production of eight pages, six of which are devoted to useful articles relevant to the subject. The producer is a member of the New England Live Steamers of Danvers, who need no introduction to our readers, and with such an enthusiastic band of stalwarts to help him, all seems set for a long and successful career for the new magazine. Respect for and confidence in our old friend "L.B.S.C.", who was the direct inspiration of the live-steam movement in America, is clearly evident.

Presumably, the little magazine, wisely started on modest lines at 25 cents per copy, will be published bi-monthly and we wish it every success.

A Simple Gauge "1" "Juliet"

by J. E. Jane

HAVING recourse recently to undertake the construction of a small locomotive, the event was, not unaturally, accompanied by certain misgivings, being my first attempt in this sphere of model engineering. However, worries, such as they were, seemed to diminish somewhat as progress was made, and despite a snag or two here and there, due, I think to, my lack of experience in such matters, the final result compared favourably with expectations.



Mr. J. E. Janes' "Juliet"

The reasons for embarking on this venture, which was in direct contrast to my previous efforts in model engineering, marine work, would really develop into quite a story. Suffice it to say that it was a case of not being able to resist the persistent pleadings of my youthful offspring for a real live "puff-puff." I suppose that is the usual position for worthy "fathers" who are handy at making, and contriving toys, and "what-not."

Now a word or two on the "whys and wherefores." The model about to be described is of a very simple nature. Knowing my facilities, and at the same time, remembering the well-known adage: "You cannot run, before you can walk," I did not intend it to be otherwise. So with this in mind, a general "look-see" through my MODEL ENGINEERS was resorted to for an appropriate example, the final choice eventually falling on "L.B.S.C.s" *Juliet* for Gauge 1.

Now, as I have no machinery, and as I would have to build by hand, even this, in its original form, was a little beyond my powers, and before work could be started in earnest, certain details had to be altered to suit the situation. For example: oscillating cylinders were fitted in lieu of the original slide-valve type; the smokebox assembly was built up; the regulator began its life as the haft of a dart; and the wheels, plus various other fittings, were improvised in divers ways.

The material used generally, was from that lying readily to hand, not to mention the scrap-box which proved invaluable on several occasions. The time occupied, from drawing up to the first test was approximately three months. Although at the moment it is just painted black, with ordinary "heat resisting enamel," this will, in due course, be removed, and replaced with the correct locomotive paint (when I can get it).

Now before continuing with the details, I would like to point out that as the original was fully described by "L.B.S.C." in THE MODEL ENGINEER, dated October 30th, 1947, I feel that there is no point in supplying a complete description of my attempt. Therefore, the following

details and drawings, will deal mainly with the modifications, and improvisions, already mentioned.

Cylinder Assembly. Figs. 2 and 4.

The fitting of the oscillating cylinders was the first job. These, together with the steam-pipe, exhaust pipes, and lubrication form, a complete unit, and are so constructed as to fit into the frames *en bloc*. For this purpose, instead of having rectangular holes, as for the slide-valve, two slots were cut out of just sufficient width to accommodate the steam and exhaust pipes. The whole assembly was inserted into position from underneath the frames, and secured with four 4-B.A. countersunk screws, two in each block. To avoid the possibility of fouling the cylinder faces, the screw heads were sunk into the blocks $\frac{1}{16}$ in. below the surface; the existing holes, being accordingly opened out to a depth of $\frac{1}{8}$ in. to accommodate the "heads."

The making of the cylinders and blocks followed my usual practice for oscillators of this type, and the characteristics should be easily discerned in Fig. 4. The blocks were cut and filed up from $\frac{3}{4}$ in. × $\frac{1}{4}$ in. brass strip, to lengths of $1\frac{1}{2}$ in. The cylinders were cut to the same length, from $\frac{7}{16}$-in. diameter brass tube, and as these already had highly-polished bores, no reaming was necessary to fit the pistons.

The steam pipes consist of two short lengths of 5/32-in. diameter copper tube, soldered to each block, and joined in the centre to a "T" junction, which was drilled and filed to shape from a piece of $\frac{3}{8}$ in. thick brass. To the top of this, was fitted a union for connecting the main steam pipe. This extends rearwards under the boiler, over the lamp flames, through a hole in the backhead, and then curves upwards to connect up to the union on the regulator. Extending forwards, and at right-angles from the junction, is another short length of tube, to which was fitted a drum-type lubricator, made from a short length of $\frac{1}{2}$-in. diameter brass tube, of light gauge, fitted with flanges, and the necessary screw plugs. When in position, this lies half under the buffer-beam; therefore, to make it accessible for filling, a half-moon recess was filed out of the beam and was covered by a plate, fashioned to a slide fit into the frames where they slope down in front of the smokebox. (See "Buffer Beam" Fig. 3.)

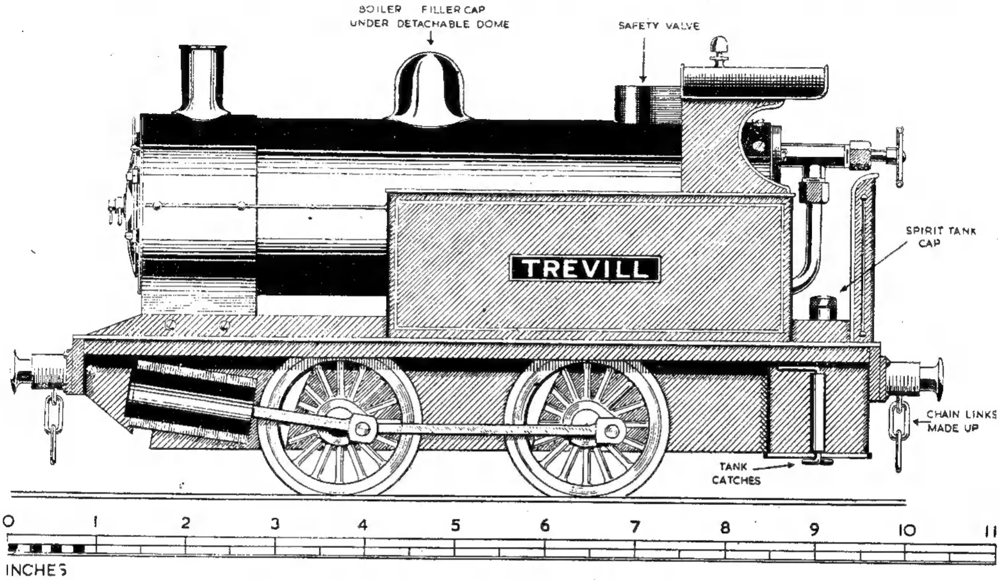


Fig. 1. Side elevation of the simple Gauge "1" "Juliet"

The exhaust pipes are two lengths of $\frac{3}{16}$-in. diameter copper tube, which curve upwards from the face blocks, then inwards to meet at the exhaust, or blast nozzle. This was drilled and filed up from a piece of $\frac{1}{2}$-in. diameter brass rod, to the shape shown in the sketch. It will be noticed that the main steam pipe union lies in between the two exhausts, hence the reason for the curves, which allows access to the union with a spanner.

Pistons, Rods, and Couplings. Fig. 4.

Pistons were cut from $\frac{7}{16}$-in. diameter mild-steel, to $\frac{3}{4}$ in. lengths, then being tapped into the cylinders with oil and carborundum powder. A $\frac{1}{8}$ in. hole was drilled through each centre to accommodate the rods, these being silver-soldered into position. Both these rods, and couplings were filed up from 18 gauge × $\frac{3}{8}$ in. mild-steel strip. For the purpose of uniformity, both groups of rods were first temporarily soldered together, before drilling the crackpin holes or filing off the design. The final polishing was carried out after separation.

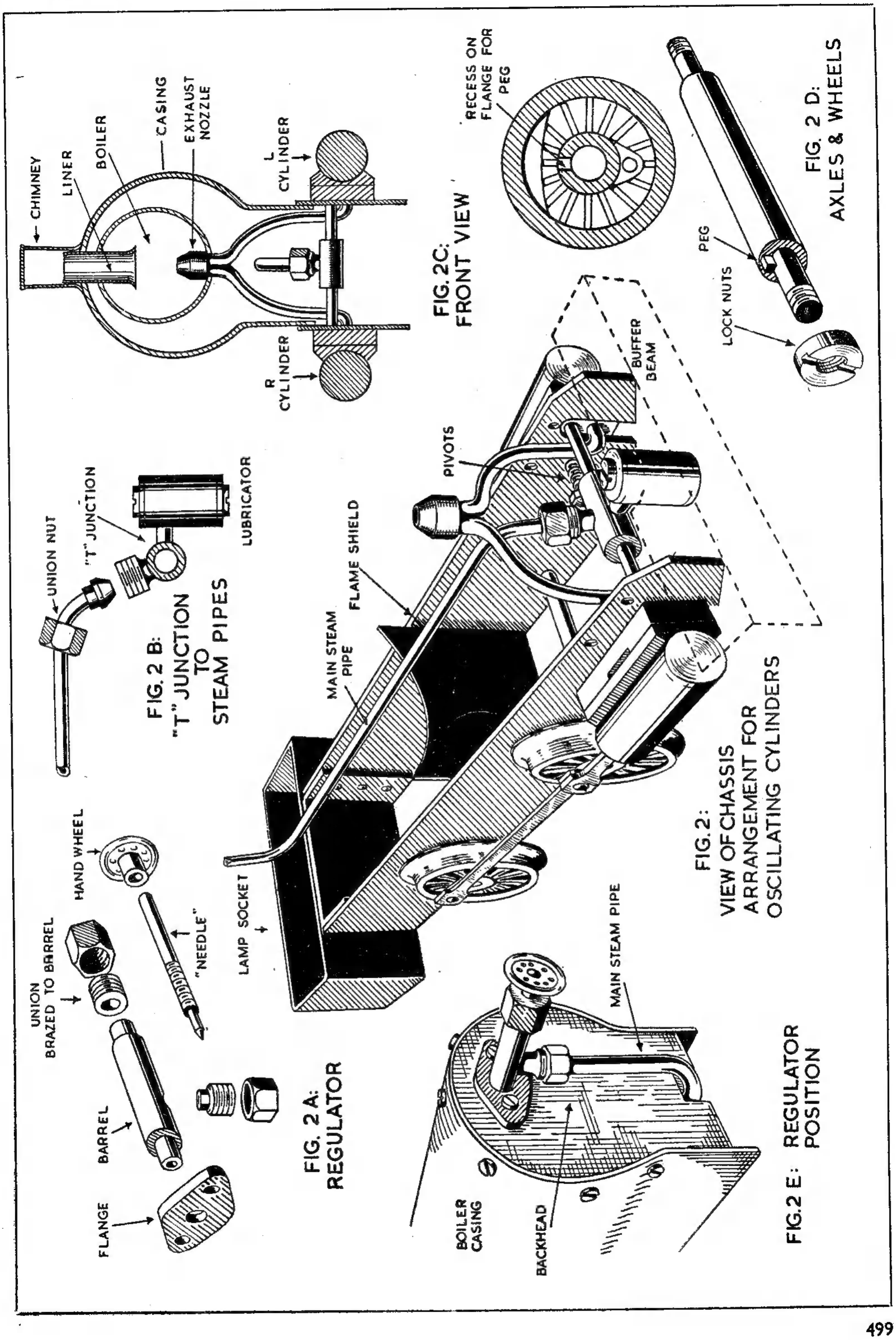


FIG. 2C: FRONT VIEW

FIG. 2 D: AXLES & WHEELS

FIG. 2 B: "T" JUNCTION TO STEAM PIPES

FIG. 2: VIEW OF CHASSIS ARRANGEMENT FOR OSCILLATING CYLINDERS

FIG. 2 A: REGULATOR

FIG. 2 E: REGULATOR POSITION

Wheels and Axles. (Figs. 2, 2D, and Diagram Fig. 1.)

The production of wheels was something of a "headache" and some time was spent in dealing with the matter. Not having the facilities for turning them up myself, other measures were resorted to. This commenced with a lengthy search being conducted virtually throughout the whole of one Saturday. The type specified by "L.B.S.C.," apart from being made to order, were just not to be had, even at the best-known shops. However, at the end of the day, after "perambulating" something like 50 miles on my "Flying Bedstead" (as I term my bicycle), and almost at a point where I was ready to admit defeat, I dropped in at Shepherd's Bush market, and there, to my utter surprise, tied up with string, in a haberdasher's shop window, I spotted a complete set of *ex*-Hornby locomotive wheels. Upon having a "look-see," I discovered that, apart from being somewhat dirty, they were in good condition, and near enough to the right dimensions. But there were no axles. These I had to make. However, to cut a long story short, I bought the lot for 1s. 6d., and ambled off home, tired, but at least somewhat satisfied.

Now I found that these wheels were fixed in a peculiar way. At the back of each, on the boss, was a vertical slot which, by all accounts, was for the purpose of sliding on to a key situated at right-angles on the axle. Sooner than "dive" off into the unknown, I decided to make the axles to suit accordingly.

Two lengths of $\frac{1}{4}$-in. diameter mild-steel rod were marked off to 1-gauge dimensions, as per the original; then, clamping each in the drill-brace, both ends were stepped down to fit wheel boss holes. Then at right-angles, close up to the step were drilled $\frac{1}{16}$-in. holes, which were fitted with steel pins, driven in.

The ends of the steps were then tapped 4-B.A., the wheels slid on and pressed home on to the pegs, and finally secured with round slotted nuts, screwing well down into the appropriate recesses. So far, although the locomotive has been under steam several times, the wheelshave not worked loose; so I imagine that this method is quite satisfactory for small jobs. The crankpins, which were supplied with the wheels, were found to be O.K.; so apart from being cleaned up, they were not interfered with.

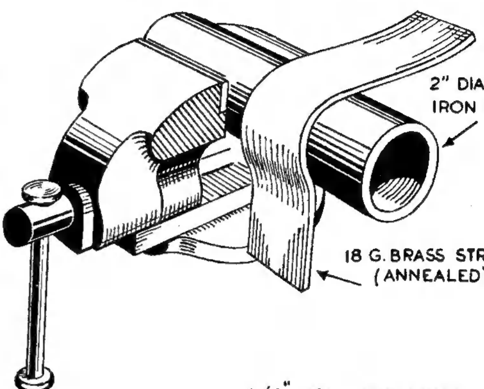
It will be noticed that the drive has been fixed to the front pair of wheels, for the following reason:

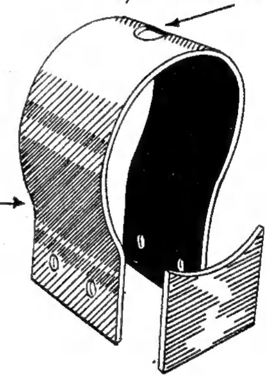
When drawing my line of motion, it was discovered that, unless longer cylinders were fitted, with the pivots brought further away from the radius of the ports, there would not be sufficient throw to allow for a dead spot, in relation to the size of the ports. So, rather than resort to that "toy-shop" look, with cylinders extending half-way along under the running-boards, I decided to retain my short cylinder, and adapt the motion accordingly.

The Regulator. Fig. 2A and 2E.

In comparison with the orthodox types, the regulator will, no doubt, appear to be somewhat incongruous. There were reasons for this. In the first place, it had to be improvised from the nearest appropriate material: secondly, the fact that it protrudes over the bunker plate, makes it accessible without having to reach half-way under the cab roof, and lastly; I was not concerned so much with appearance, as I was with obtaining efficiency, particularly in view of the material question. Looking around for something suitable, I discovered an old dart, the haft of which seemed to present possibilities.

FIG. 3 A.
FORMING SMOKE BOX





After removing the point and vanes, the consequent hole, which was about $\frac{1}{16}$ in. diameter, was opened out to 5/64 in. diameter. Then the haft was cut down to the required length, and squared off both ends. The hole was then opened out once more with a No. 34 drill to a depth of 1 in., and tapped 4 B.A. Half of this length was then opened out with a No. 27 drill. Inserting the "haft" into the drill brace, a "step" was filed down to a depth of 1/32 in. $\times$ $\frac{1}{4}$ in. long. This was for the purpose of sliding on, and silver-soldering into position the sawn-off threaded portion of a union, which was to form part of the packing gland. Removing the "haft" another step was filed down at the opposite end, $\frac{1}{16}$ in. deep $\times$ $\frac{1}{8}$ in. wide, to fit into the flange, which was fashioned from $\frac{1}{8}$ in. thick brass sheeting. The 5/64 in. hole at this end, was then drilled out $\frac{1}{8}$ in. deep, to a depth of 3/32 in., to accept a length of $\frac{1}{8}$ in. o.d. copper tube, to

form the tail steam pipe for insertion into the boiler.

The " needle " was fashioned from a length of 5/32-in. mild-steel rod. First, one end was brought to a tapered point, then " stepped " down to $\frac{1}{8}$ in. diameter, for a length of $\frac{1}{4}$ in. The front end was then tapped 4 B.A. To the rear, was fitted a small hand-wheel, made from a $\frac{3}{4}$-in. diameter brass disc, the edge of which, was

dome to boiler casing. The whole is detachable, for the purpose of access to boiler filling-cap.

The Smokebox Assembly. (**Figs 3, 3A, 3B**).

Although, not shown on the original, I decided that the addition of a smokebox would add, to, or at least improve the general appearance, and consequently began to set about the job of making one up. Like the wheels, this was to prove

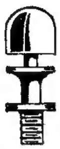


FIG. 3 E: DUMMY WHISTLE

FIG. 3 D: DOME

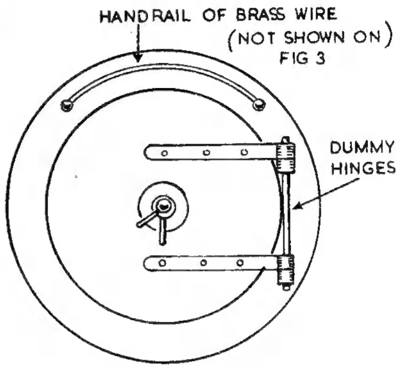
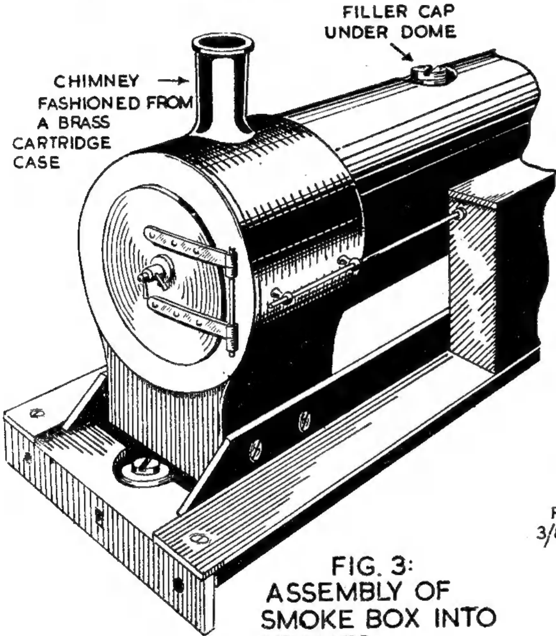


FIG. 3 C: SMOKE BOX DOOR



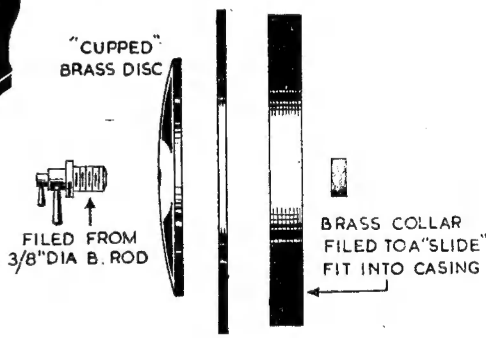


FIG. 3: ASSEMBLY OF SMOKE BOX INTO FRAMES

filed half-round to form a seating for a length of coil spring, soldered into position. Under the " bonnet " another hole was drilled, to which was fitted the main steam pipe union.

The Chimney. (**Fig. 3.**)

This was fashioned from an expended 0.303-in. cartridge-case ; all that was necessary was to drill out the cap, cut to the required length, $\frac{3}{4}$ in., and flange the bottom to fit the smokebox, to which it was silver-soldered.

The Dome. (**Fig. 3D.**)

This was made from a length of $\frac{3}{4}$-in. diameter brass tube, and fitted with a " cupped " top, which was beaten out on a block of lead. A collar was fitted underneath for the purpose of attaching

something of a problem to fashion by hand, and quite a few weary moments were to elapse before a satisfactory method was found. However, necessity once more proved to be the mother of invention and resulted in the following :

First, a strip of 18-gauge brass, $1\frac{1}{4}$ in. wide was prepared, annealed, and bent round to shape with the aid of a length of 2-in. diameter piping as shown in Fig. 3A and 3B. Then the hole for the chimney was filed out, over which this component was silvered-soldered. Then a plate was cut from a piece of the same gauge of brass, filed to fit in between the sides, as shown in Fig. 3B, and silver-soldered into position.

Then finally, the four holes were drilled and tapped 5 B.A. to receive the securing countersunk screws, through the frames, as shown in Fig. 3.

The Door. (Fig. 3c).

This is a dummy, and is just made to a slide fit into the front of the casing. First, a "collar" was sliced off a length of $1\frac{15}{16}$-in. brass tube. Then a brass disc was cut to a $2\frac{1}{8}$ in. diameter and another to $1\frac{3}{4}$ in. diameter, and slightly "cupped" out on the lead block. The three items were then silver-soldered together. The clamps were filed out of a piece of $\frac{3}{8}$-in. diameter brass rod, and fitted with handles made of 3/64-in. brass wire; this was then inserted through an appropriate hole drilled in the door, and secured with a 4-B.A. nut.

The hinges were fashioned from $\frac{1}{8}$-in. wide brass strip, and a short length of 1/32-in. steel rod; they were riveted into position with ordinary pins, cut to the required lengths.

The hand-rails, and stanchions, were made from 3/64-in. brass wire, and $\frac{1}{8}$-in. diameter, lengths of brass rod.

The buffers were made of $\frac{1}{2}$-in. diameter brass rivets fitted in sockets fashioned from short lengths of brass tubing, silver-soldered to base-plates which were in turn riveted to the requisite positions on the buffer-beams. And that just about concludes the details of the improvisations, and modifications.

The remainder, i.e.: cab, bunker-plate, tanks, boiler-casing, frames, boiler, buffer-beams, not to mention the lamp, were, as mentioned previously, made as near as possible to the original specifications. And, in view of the fact that *Juliets*, both "1" and $3\frac{1}{2}$-in. gauge, are to be seen in various forms, more or less constantly, in these pages, I do not think it would be necessary for me to supply these remaining details.

Coming to the tests, and performances, these were few and varied, but quite up to satisfaction. The first test of the completed chassis was carried out about the end of the first month of construction, and in a way which may seem somewhat comical to our more experienced readers. A 6-ft. length of track was built up and temporarily laid in the workshop. A test boiler was "parked" about half-way, and a long rubber tube connection made to the main steam pipe on chassis. Steam was got up, and results awaited. They were not long in coming. The chassis put up quite a show, and indicated that at least the "ports" seemed to be O.K.

Of the final tests, I am only able to supply details of what was done on a 30-ft. length of straight track, as this is all I have at the moment. Therefore, the test consisted mainly of several straight runs, under a head of steam, which to my surprise, in view of the small boiler, was kept up for about 20 minutes. On the first run, she was off on her own, tamping along like a "Jack in the Box." However, a few more of these, and I began to wonder what the pulling power was, so "knocking" up a temporary truck out of some wood, and an odd set of wheels, I coupled it up to "Tin Lizzie" and loaded it with metal blocks, a few at a time, on each run. Finally, I packed on as much as I could, crossed my fingers, and opened the regulator. With a few hearty, reproachful "chuffs," she was away. Weighing this load up afterwards, I discovered it to be 18 lb., not bad for a locomotive, that is only 6 lb. or so in weight, 10 in long, and has only single-acting oscillating cylinders.

The name *Trevill*, might cause a few quizzled thoughts to meander through the minds of our readers. So it has occurred to me that perhaps a few details on the origin, might be appropriate, particularly in view of the fact, that there is a fair amount of history concerned.

The original *Trevill* (or *Trefil* as it is more often spelt) was one of several 0-4-0 saddle tanks owned by the old Ebbw Vale Steel, Iron, and Coal Company, which no longer exists, being superseded by Richard Thomas & Company. As a boy, I can well remember the *Trifel*, as pronounced locally, "doing its stuff" around the district, one day pulling ladles of liquid iron from the blast furnaces to the bessemer, another day, general shunting, but more often that not, employed in transporting limestone from the Trefil Quarries, way up on the Brecon Moors. These quarries were opened years ago, and were used to supply the old Ebbw Vale Iron Works, which were in existence long before Bessemer was thought of, and when "puddling" was the fashion for producing high-grade metal. The present line to the quarries is comparatively new, being laid round about the 1900 period, and pursues a difficult course. But the old Dram, or Tram Road, as it is called locally, has partially disappeared, although there are still sections where some of the old original lines can be seen. It took its name from the fact that the "Drams" were horse-drawn, except for some points, where the gradient being too steep, I believe stationary steam haulage engines were used. There is, or was, only one other "Rail Road" in that part of the country which was similar in aspect, and that was the old Pendarryn Iron Works Road, the foundation of which can still also be seen.

Well, I don't want readers to misunderstand my intentions here, which are merely to imply what lies behind the name of a locomotive, not to write history, a subject on which I am no great authority. But before conclusion, there is one other point, which might prove of interest. It takes the form of an incident, in which one of the work's 0-4-0s of the *Trefil* type was involved. One of the duties of those locomotives was to run in a ladle to collect the slag from the blast furnaces, which was afterwards taken up the "tips" on the hill side, for disposal. These tips, being in constant use over a period of years, had assumed enormous proportions, and from base to tip, were, in some cases, well over 100 ft. Along the top temporary lines were laid to enable the ladle to be pushed right up to the edge, where it was "chocked" in position, and uncoupled from the locomotive.

The locomotive chain was then attached to a draw-bar on the ladle, which caused it to be tilted, upon the engine being reversed, thus emptying the contents. Upon the occasion in question, the latter stage had not been even reached. The ladle had just been pushed up against the chocks, when, according to the labourers employed on the spot, the tip under the rail head, gave way, whereupon the ladle, still coupled to the engine, toppled right over, dragging the engine with it, and amidst a veritable cascade of liquid fire, bounded to the bottom like

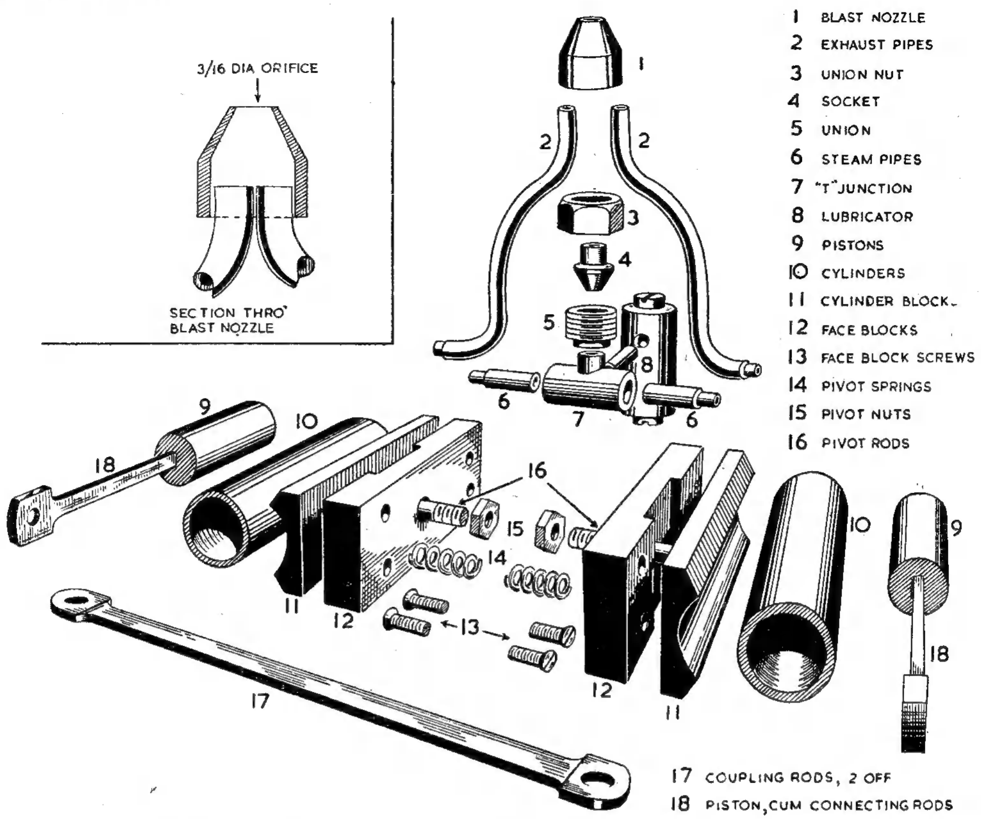


Fig. 4. EXPLODED VIEW OF THE CYLINDER GROUP

enormous cannon balls. The sight can well be imagined, particularly when the water from the engine boiler and tanks, contacted the liquid slag.

What with the glare and explosions the first impression in the town was that one of the blast furnaces had blown up. Fortunately, there were no fatal casualties, as apparently the driver and fireman were able to jump clear, with only minor injuries. We were used to glares in those days, particularly when the bessemer was "blowing," which used to take place about every half hour, night and day for five days in the week. But the occasion in question certainly was exceptional.

Well, that's that. I hope that some interesting reading will be obtained, and above all, that some insight will be gained as to yet another little *Juliet*, probably the simplest of the lot to date.

A Book of Austrian Locomotives

We have been favoured by the receipt of a copy of a remarkable book from Austria. It describes and illustrates what appears to be every type of locomotive put into service on the Austrian State Railways since 1893, in which year Dr. Karl Goldsdorf's compound 4-4-0 type was the latest design. There are 92 pages, size $8\frac{1}{4}$ in. by $11\frac{3}{4}$ in., and the illustrations are made up of half-tones and clear line diagrams. The arrangement comprises a number of sections dealing respectively, with: Standard-gauge steam locomotives of Austrian origin; standard-gauge steam locomotives of foreign origin; narrow-gauge locomotives; electric locomotives and electric powered carriages; powered carriages with internal-combustion engines, and tables of main dimensions.

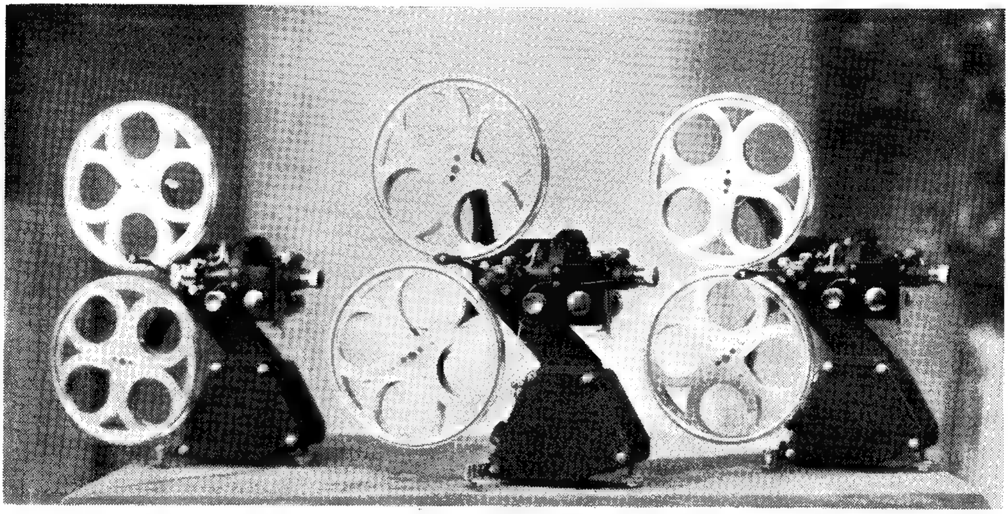
The text is in German, or rather, the Austrian version of that language, and the whole production is excellent. The compiler, Hanns Stockklausner must have spent much time in research and a great deal of care in arranging the material in its proper chronological order; the result is most fascinating and of great interest. It is published at 15 schilling by Zeitschriften-Verlag Ployer & Co., Wien VI, Agidigasse 5. We understand that, at present exchange rates, the Austrian schilling is 72 to the £1.

A Device for Cutting Spiral Gears

by F. H. Curl

WHILST constructing ■ series of three projectors, the problem arose of finding a method to cut the teeth on ■ spiral gear both quickly and easily. The projectors, which were made from drawings supplied by Messrs. Racet Designs, were a semi-commercial proposition, in so far as two of them had to be sold to provide held down the index gear. On the cam sleeve the cam itself bears on ■ flat filed on the projecting end of a taper pin fitted in the spindle. As for the cutting tool, it is held in its usual place in the lathe toolpost.

Before dealing with the gear-cutting procedure, ■ few hints on the construction might be welcome.



Mass-produced prcjectors

film for the other, and so the use of expensive and elaborate gadgets was ruled out.

There was a pair of these spiral gears for each projector, of transmission ratio 1 : 1, set at right-angles with a helix angle, therefore, of 45 deg. As two of my friends required pairs of gears for similar projectors, a total of 10 separate gears had to be cut.

The apparatus available consisted of a lathe and the usual bench tools, but, fortunately, a gear was found that could be used for indexing, with one small snag, namely, that the proposed index gear had one more tooth than was specified in the projector design. The only answer to this was to adjust the tooth dimensions of the projector gear to accommodate the extra tooth.

As shown in the sketches, the resulting device was used in conjunction with the lathe, being mounted in the tailstock. It consisted essentially of two sleeves revolving on ■ spindle, one of which had ■ cam cut on it corresponding in angle to the helix of the spiral gear. This sleeve carried the indexing gear, whilst the other sleeve carried the gear blank, and was fitted with a plate to which was attached the index detent. Extensions of this plate served as handles, as can be seen in the perspective view.

The two sleeves were held together by two clips which were screwed to the plate and The two faces of the index gear needed to be true to work smoothly against the clips, and though the gear was required to revolve easily, no perceptible play was wanted. The method used to ensure the former effect was simply that of skimming the gear fitted to the cam sleeve, still very tight on the spindle, which was being used as the mandrel in this case. The close fit was ensured by filing the clips about ■ "thou." on the tight side, and finishing by scraping under the lip.

Another point was that the detent spring had to be sufficiently strong as to ensure that the detent went right home each time, and it was for this reason that the sleeves had to run smoothly, and also that correct aligning of the spindle was necessary. The gear blanks had to be held securely, and to this end, two fixing screws were used, one through the main axis, and the other engaging with ■ flat on the boss, although, of course, any sound chucking device could have been used.

The cam was marked by cutting a strip of shim metal very carefully, straight along one edge, and at an angle of 45 deg. along the opposite edge. This strip was then wrapped around the cam sleeve, and the profile scribed. The cam was then carefully filed nearly to this line and finally the cam and bearing face on the taper pin were

made true to each other by marking, filing and scraping.

It was not essential, but it proved very convenient that the cam was made of the same diameter as that of the pitch circle of the gear, as the use of different diameters would have involved a long calculation of the helix angle. Finally, the cutting tool itself was made, in the same way as a parting tool with an angle of 45 deg., by grinding it diagonally across the end of a square bit.

The method of cutting the gears was as follows: With its centre-point at lathe centre height, the tool was set, and then the top slide was locked. Placing the apparatus securely in the tailstock, that and the barrel were firmly locked. The cross-slide was set to work rather stiffly, and when the tool had been moved into contact with the blank, set to zero. After these preliminaries, the first cut was made by taking hold of the handle and pulling it forwards, which

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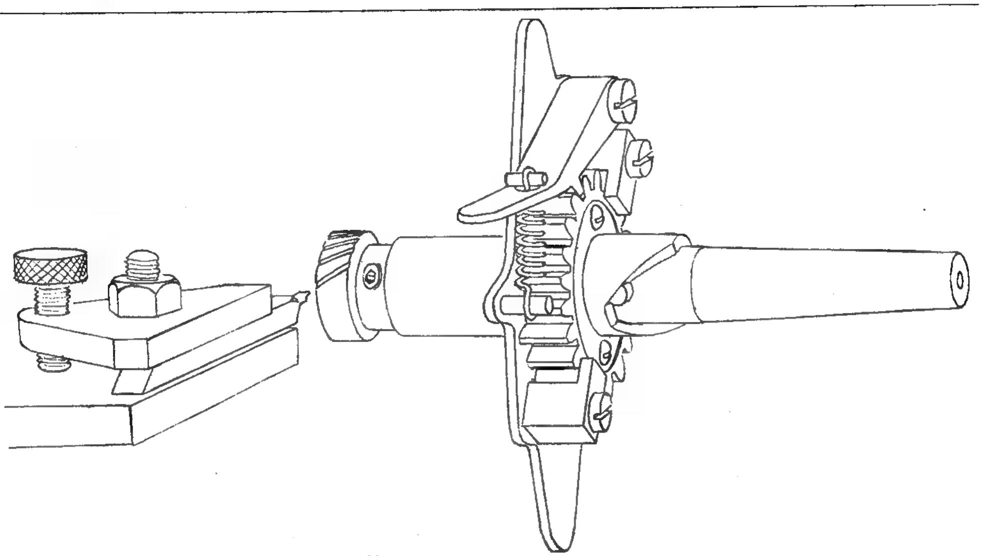
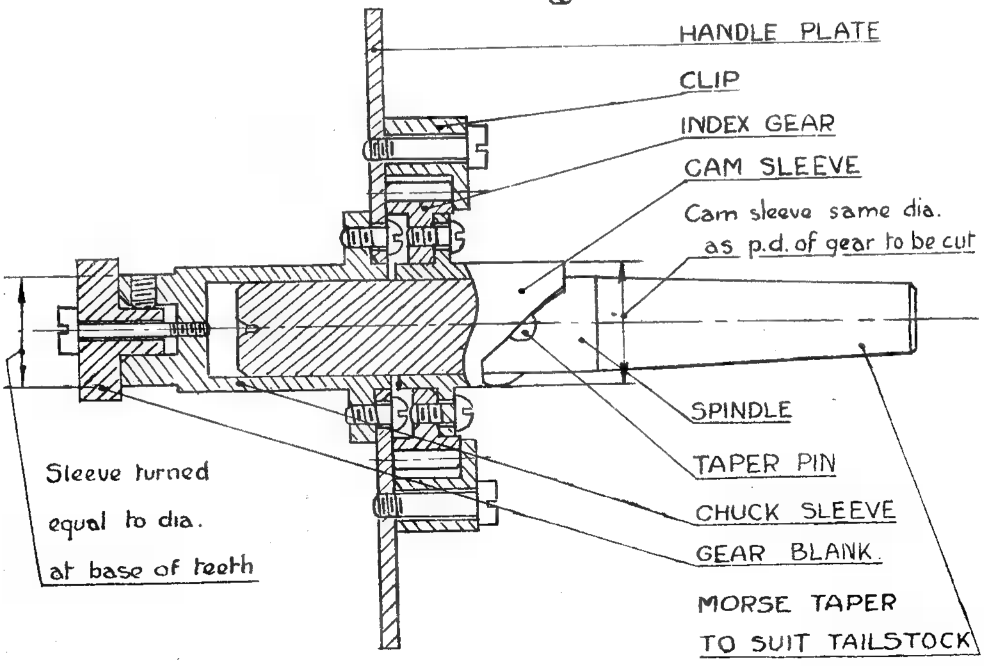
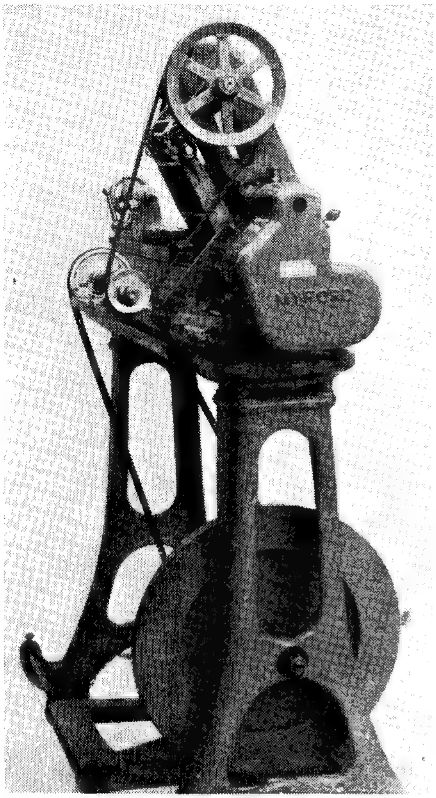
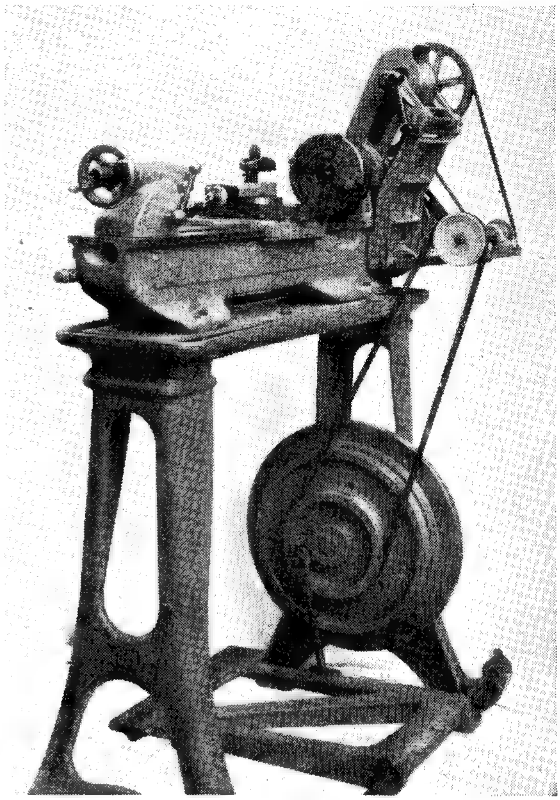




Treadle Adaptation for the Myford M.L.7





THE following is a description of how a Myford M.L.7 lathe was adapted for treadle operation to a customer's design. It may be of interest to others who might want to effect a similar conversion in the event of electrical power not being available.

No drastic alterations were made to the lathe itself and an effective change back to motor-drive may be accomplished as and when desired.

First, two ¾-in. bore plummer blocks were fitted to the top of the motor swing plate. At the change-wheel end, a ⅜ in. × 2½ in. dia. "M" size pulley was mounted to drive direct to the 7-in. dia. pulley on the lathe countershaft, employing a ⅝-in. belt. At the opposite end of the intermediate countershaft, a 4-in. "A" size pulley is fitted to take a 68-in. long vee-belt. This drives from the smallest cone on the treadle flywheel, which has a diameter of 8 in.

The treadle stand is of the usual standard design fitted with a four-speed ball-bearing flywheel. Two long strips of 3-in. × ¼-in. mild-steel were fitted to take the chip tray.

Full sets of parts are available for carrying out the conversion from Corbetts (Lathes), Stanton Hill, Nr. Mansfield, Notts.

A Device for Cutting Spiral Gears

(*Continued from previous page*)

pushed the gear blank into the first cut.

The blank was then withdrawn by moving the handle back, keeping the cam pressed against the pin. One tooth was indexed, the process repeated, and so on all round the blank. Setting the tool forward each time, the whole operation was repeated again and again, until the full depth was reached. A very good gauge of this was found by making the diameter of the sleeve immediately behind the blank act as such a gauge.

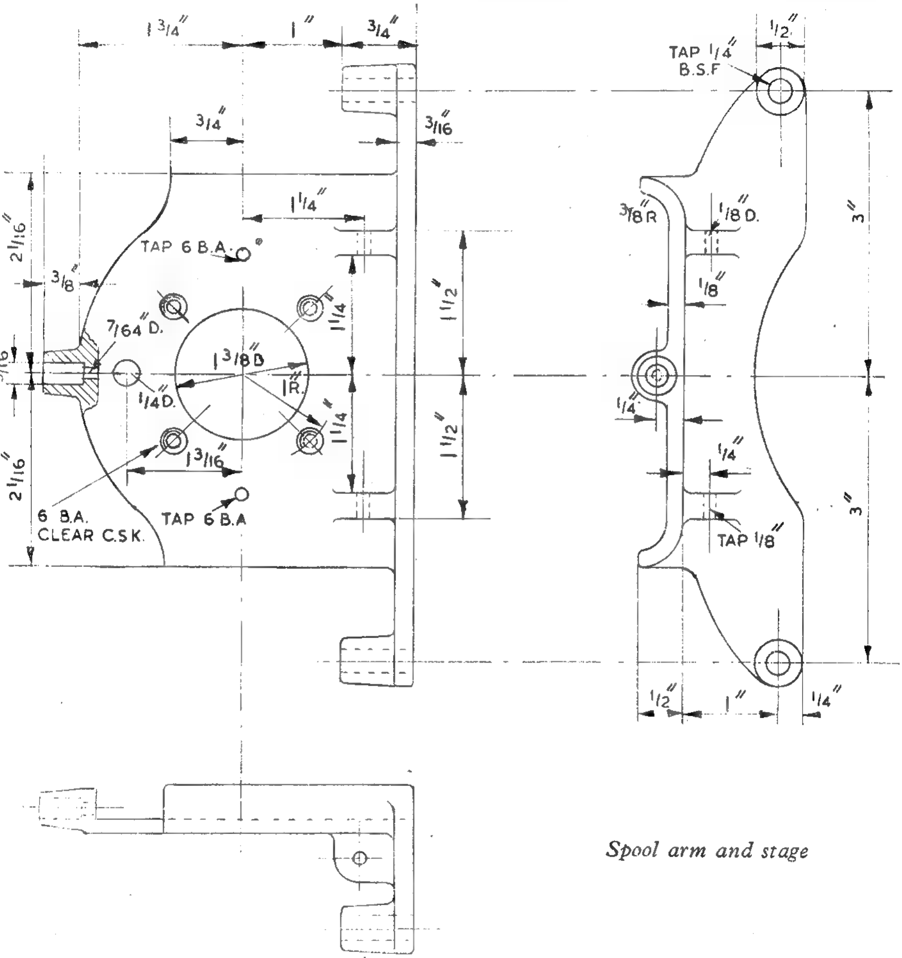
Though this process has required a wordy explanation, it can be, and was, carried out rapidly. The gears were 1 in. in diameter, and had 36 teeth, but the cutting time was eventually reduced to 20 min. each.

*Miniature Slide and Strip Projectors

by "Kinemette"

THE means provided for carrying the filmstrip, and passing it through the focal plane of the optical system on this projector, are the simplest possible, but are capable of being improved and elaborated by the constructor, if he desires to do so. Some of the more use of a sprocket or claw to engage the perforations of the film, in addition to other mechanical parts; it is also necessary to ensure that the frame is initially located in the correct position when first inserted.

Other refinements include winding devices



Spool arm and stage

expensive filmstrip projectors on the market have very ingenious devices for effecting an instantaneous shift of the film frame, embodying a device similar in some respects to the intermittent motion of a cinematograph, with a trigger action which moves the strip through the exact distance required to change the picture when operated. This generally involves the which dispense with spools or rollers, and sometimes eliminate the need for rewinding the strip, by providing a revolving take-up cylinder, at an angle to the normal path of the film, and feeding the film into the centre of it. While these devices are attractive and undoubtedly facilitate convenience in handling the projector, they do not in any way improve the *efficiency* of projection, as such. It is quite easy to centre the frames accurately by hand operation of the take-up spool, and an over-run is just as easily corrected

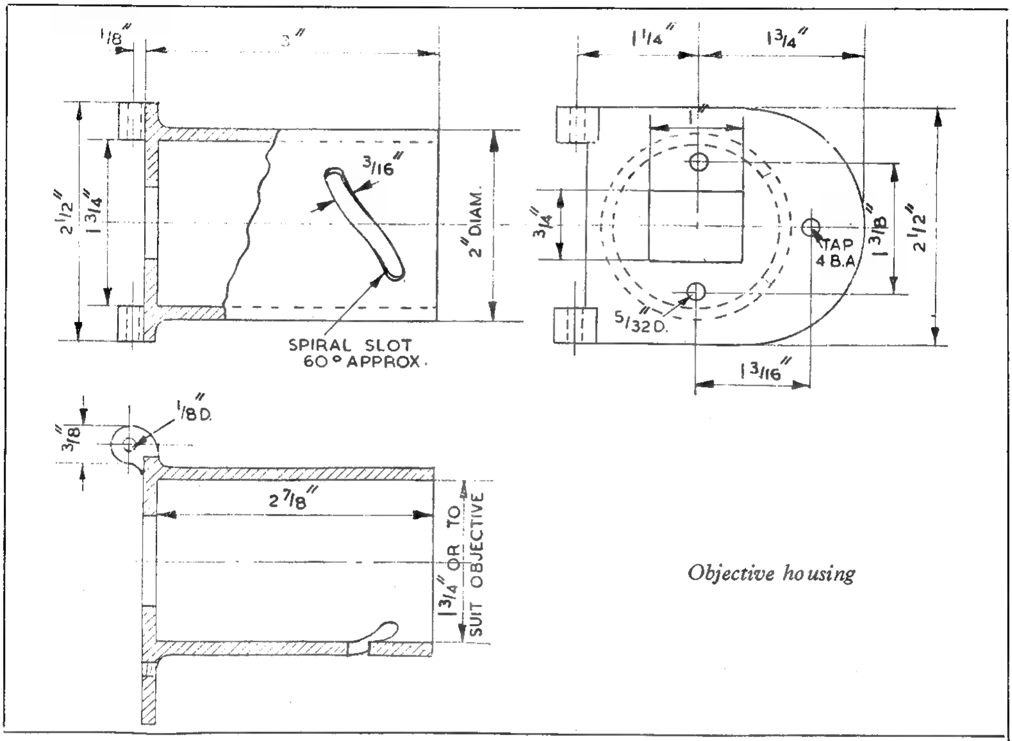
**Continued from page* 430, "*M.E.*," *March* 30, 1950.

by winding back on the feed spool; while, if it should be found desirable to refer back to an earlier picture on the strip, it is much easier to do this with the simple winding gear than with the more elaborate mechanism. In normal use, it is rarely necessary to run through more than two or three filmstrips at a single session—one strip will carry the complete subject matter of a technical lecture, in most cases—and as the strips are normally not more than three to four feet in overall length, their rewinding by hand cannot in any circumstances be regarded as a tedious or complicated operation. It may be observed that some experimental work has been done on the kind of devices mentioned above, and while it has not been thought desirable to incorporate them in the projector now being described, some further information about them will be furnished if it is found to be of general interest.

Spool Arm and Stage

A casting is specified for this component, but it could quite easily be fabricated from stock material if preferred. It incorporates a flat plate with curved-back ends, and a vertical member disposed at right angles along the edge, having bosses at upper and lower ends to take the spool spindles. As with other castings in this projector, very little machining is necessary; it is desirable to clean up the front and back of the stage plate to produce flat and parallel surfaces, but unless one has more precise methods readily available, filing and scraping will produce quite satisfactory results. The bosses of the spool arm should be drilled and tapped parallel both ways, and spot-faced on the inner side. On the same plane, a hole is drilled and counterbored in the lug of the stage plate to take the latch plunger.

The holes for the hinge pin of the gate call for careful marking out to ensure that the gate lies parallel to the stage plate when closed. It is advisable to use a scribing block to locate the hole centres, by laying the casting on a parallel packing block on the surface plate (or other true surface) with the front side upwards, and the scriber point set to a height which gives $\frac{1}{4}$-in. clearance over the front of the stage plate. The end faces of the hinge lugs should be coated with marking blue or other preparation to show up the lines clearly.

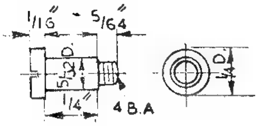


Objective housing

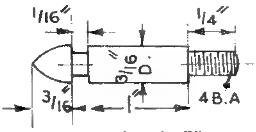
Providing that the side surface of the spool arm is reasonably true and square with the holes (it is desirable to ensure that this is so, by filing if necessary, before drilling the holes) the casting may now be stood on its edge and the scriber point set by measurement from the centre of the stage aperture to mark the cross lines on the end faces of the hinge lugs. Centre-punch the intersection, and drill the holes carefully so as to keep them in line; the upper hole should preferably be drilled with a No. 31 drill and finished with the $\frac{1}{8}$-in. reamer so as to ensure exact size, while the lower hole is drilled to $\frac{1}{8}$ in. or 5-B.A. tapping size, and finally tapped accordingly.

The stage is attached to the front of the con-

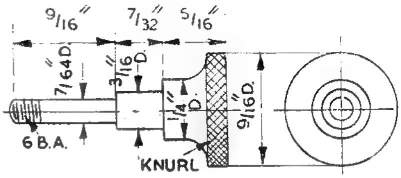
denser housing by four 6-B.A. countersunk screws, and located so that its aperture is exactly central with that of the condenser cell. If there is no cored hole in the stage plate, or if it needs to be machined to size, it is practicable to swing the entire assembly in a lathe of 4-in. centres, by mounting the rear flange of the housing on the faceplate, with the condenser cell set to run truly, so that the concentric location of the aperture may be ensured by boring it *in situ*.



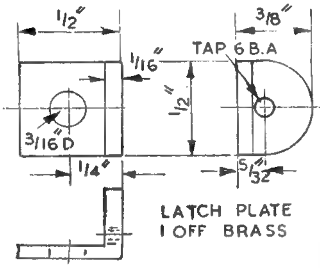
SPRING GUIDE SCREWS
2 OFF M.S



LATCH PIN 1 OFF M.S



LATCH PLUNGER 1 OFF M.S



LATCH PLATE
1 OFF BRASS

Objective Housing

This component also may be made either from a casting, or by fabrication from tube and sheet. Both the internal and external diameter of the objective housing will depend upon the size of objective used; the older types of 35 mm. cine-projectors designed for school and lecture work often use an objective mounted in a tube of 42.5 mm. (approx. $1\frac{11}{16}$ in.) external dia., and as some of these objectives are still to be found in second-hand optical shops, at a reasonable price, the standard has been provisionally adopted for this projector.

After machining the inside and outside of the housing, the rear side should be faced flat and the aperture filed or milled out. The hinge lugs are then marked out for drilling, using similar methods to that of the previous component except that when marking the cross lines, a vee block should be used to support the housing, and measurement taken from the centre of the bore. The holes are drilled from either end, and finished $\frac{1}{8}$ in. diameter, as before. A piece of $\frac{1}{8}$-in. mild steel rod, 3 in. long, screwed at one end and slotted at the other, forms the hinge pin. It may be found desirable to spot face or pin-drill the adjacent faces of the lugs in both components, but no end play in the hinge joint should be allowed; should it exist, a shim or washer should be interposed either at the top or bottom, to take it up.

With the hinge pin fitted, and the housing opening and closing properly, it should be set in working position for marking out the hole for the latch pin, using a wood or metal packing block of the required thickness to locate the adjacent surfaces exactly parallel, and holding them thus by means of a light clamp for marking out. The hole in the housing flange is tapped 4-B.A., and that in the stage plate, which should be exactly in line with it, is opened out to an easy clearance fit for the latch pin.

Latch Components

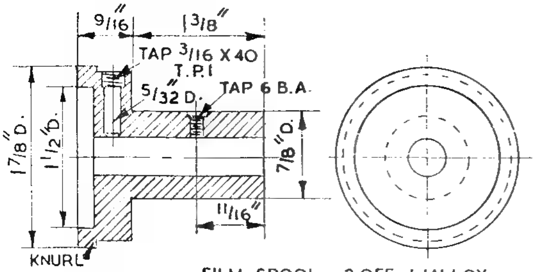
The latch plate is made from a small piece of angle section brass (or other reasonably hard metal, but not soft aluminium) and it may be found desirable to smooth the working surface with a dead smooth file and emery cloth, so that it slides freely on the back of the stage plate. It may also be desirable to mill or file the seating surface for the same reason. The tapped hole for the plunger should be marked out by placing the plate in position and scribing through the hole in the plunger lug, or, better still, clamping it in place and spotting the hole with a 7/64-in. drill, prior to drilling and tapping 6-B.A.

It is immaterial whether the plunger is made in one piece with its knurled head, or whether the latter is made separate and screwed on, but in the latter case, a brass or duralumin head and a mild-steel shank may be used. The turned-down end of the shank should be screwed 6-B.A. for just sufficient length to screw firmly into the edge of the latch plate, so that when the plunger is in position with a suitable compression spring on the shank, it has about $\frac{1}{16}$-in. latitude of movement. In the fully-depressed position, the hole in the latch plate should register with the clearance hole in the stage plate, so that the pointed end of the latch pin will enter, and the latch plate will then spring into the groove of the pin and lock it. A slight bevel filed on the entering edge of the hole in the plate will assist smooth working.

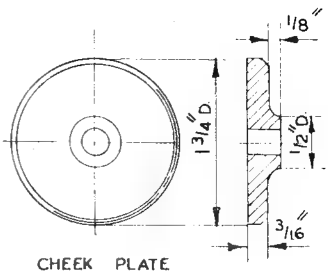
The length of the latch pin may have to be adjusted slightly, to ensure that the objective housing is axially aligned. The provision of a locknut on the screwed end of the pin will allow of some adjustment in this respect, but it is best to arrange matters so that the pin can be screwed firmly home against the flange of the housing, or a distance washer interposed, in addition to being locked by the nut.

Film Spools

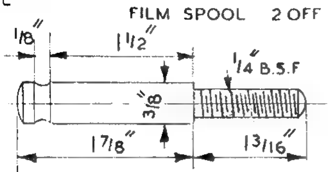
In order to combine simplicity of construction with ease of manipulation, the film spools are made detachable and single-sided, a stationary cheek plate being fixed on the inner side of each spindle to confine the film from moving to this side. The particular arrangement has been arrived at after experiment with several types of



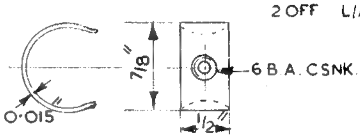
FILM SPOOL 2 OFF L/ALLOY



CHEEK PLATE 2 OFF L/ALLOY



SPINDLE 2 OFF M.S

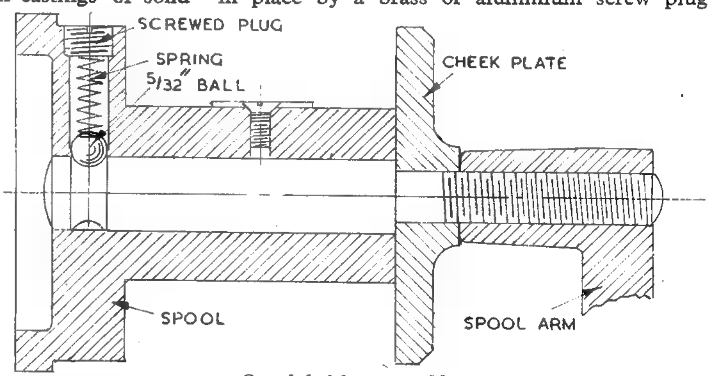


SPRING CLIP 2 OFF SP STEEL

spools, including that commonly used in cine-projectors, where a separate spool is normally provided for each film, but this complicates the matter of fitting and winding the spools, also packing and carrying films. Permanently mounted spools make it necessary to wind or unwind the film each time the film is fitted and removed, and it sometimes causes confusion in deciding which end of the film is which when this method is employed, until the operator is used to working the projector thus fitted. The detachable spool enables the end of the film to be clipped in place without unwinding, and just as easily detached at the other end.

The two spools are identical in construction, and may be made either from castings or solid light alloy bar. No special instructions for machining are necessary, as the main machining can be done at one setting, including the facing, turning the reduced end to $\frac{7}{8}$ in. dia. and drilling the centre hole, which should be finished by reaming to a smooth working fit on the $\frac{3}{8}$-in. spindle. The spool is then reversed and the recess bored, also the large end machined and the rim knurled or serrated to provide a hand grip.

Two radial holes are drilled in the spool, one being tapped for a 6-B.A. screw to secure the film clip, and the other, which is 5/32 in. diameter, is tapped at the mouth only, for a depth of not more than $\frac{1}{8}$ in., to take a plug screwed $\frac{3}{16}$ in. $\times$ 40. It should be observed that the 5/32-in. hole, which takes the ball and spring, must on no account be drilled completely through into the bore, but a small lip must be left to prevent the ball from falling into the bore. The best way to ensure correct depth is first to drill a $\frac{1}{8}$-in. hole right into the bore, then temporarily fit a brass or aluminium plug in the latter. Then counterbore with the 5/32-in. drill, proceeding cautiously until it touches the plug. With a drill of normal face angle, this will give just about the correct depth to locate the ball, but should slight extra depth be necessary, it can be produced by hand application of the drill—that is, simply twirling it with the finger and thumb—while watching the effect from the inside of the bore. If one should be so unlucky (or careless !) as to run the drill right through, it is, of course, possible to plug the hole and start again in another place ; but the contingency should not arise. A 5/32-in. cycle ball, and a short length of spring just small enough to slide in the hole, are retained in place by a brass or aluminium screw plug which should be finished flush with the surface after fitting.



Spool holder assembly

The spring clip to anchor the end of the film is specified as being made of spring steel, but hard brass, such as shim metal, has been found satisfactory and is much easier to work. It should be bent so that it lies closely on the spool, the extreme ends being very slightly turned up so that it is easy to insert the end of the film. The hole is countersunk deeply, so that the fixing screw will lie flush with the surface, and

(*Continued on next page*)

Simplicity the Keynote of Success

WE have been much interested in some shrewd comments by Mr. Dan Hollings, which he has written in a recent number of the Bulletin of the West Riding Small Locomotive Society. He states that he was loaned some drawings and a mass of technical data regarding the Southern "Merchant Navy" Pacifics, and he offers a respectful warning to people who may be fancying one of these engines as a prototype to copy in model form, and gives the advice that it would be better to look elsewhere. He writes :—

"This three-cylinder engine with a mass of intricate chain-driven valve-gearing, enclosed in an oil-tight gearcase holding 40 gallons of oil, fitted with pump pressure oil feeds, etc., and all between the frames at that (!), is anything but an ideal prototype to follow for a successful working model. However clever the mechanic, or excellent the workmanship, the maintenance in model form would certainly be a constant worry, the reverse of what some of the older types of trouble-free, plodding steam locomotives can be, and are expected to be.

"At almost the other extreme, I was recently inspecting three 0-4-4 Tank engines, *ex*-L.N.E.R. G5 class, obviously suffering a lot from poor maintenance, yet doing a daily job of work. The makers' plates revealed that they were built in 1900! There are about 119 of these engines in service, all about 50 years old. Significant, this! None were scrapped last year, but many engines, 20 or more years their junior, were. Obviously, the 19th-century designers and engineers did build to last; all credit to them. For medium powers, the older designs seem to be capable in every way and, in certain cases, are not to be despised . . . Be wise then, you small locomotive builders! If you require an engine to work with a minimum of trouble and upkeep, you will, in my opinion, be more likely to succeed if you go back 50 years or more for choice of prototype."

This is sound advice, even if it is unlikely to meet with universal approval. Whatever opinions may be held on different types of modern locomotives, there can be no denying that recent design has tended towards complication; and this does not react in favour of the constructor of miniature locomotives. Mr. Hollings' advice has the great merit that it opens up a vast field in the matter of choice of prototypes, the design of which was plain, simple and straightforward, in the main. The large number of old locomotives that are still in use, and successfully holding their own against modern requirements, tells its own story, and we shall not be surprised if, when the new British Railways standard types of locomotives are built, we shall find that they are of the simplest possible design consistent with modern requirements. If this does eventually prove to be the case, we can well imagine that it will be looked upon as a retrograde step by many enthusiasts; for there are some among us who think that unless everything in engineering is absolutely the last word in "modernity," no progress is being made! But there are others who believe that simplicity is the keynote to success. And who is to say that, after all, this latter idea may not be the preferable one?

We have only to think of the modern miniature steam locomotive in its hundreds of thousands, to find the basis of our ideas. Basically, there is very little difference between the modern product and that of fifty years ago; but the performance has been improved beyond all comparison. Clearly, some progress has been made, somewhere!

Miniature Slide and Strip Projectors

(*Continued from previous page*)

it will be found necessary also to countersink the mouth of the tapped hole, as indicated on the drawing, to enable the screw to go deep enough to grip the spring clip.

A piece of ⅜-in. bright mild steel may be used for the spindle, no machining of the outside surface being necessary. The groove to locate the spring ball of the spool should be turned with a keen round-nosed tool, and should not be so deep as to trap the ball immovably; if, however, this should occur, the remedy is usually to be found in increasing the width, or rather the radius, of the groove with a hand tool or a broader-nosed tool. The end of the spindle is turned down to ¼ in. and screwed B.S.F. or similar thread, to screw into the bosses of the spool arm; a tailstock die-holder should be used to ensure axial truth of the thread.

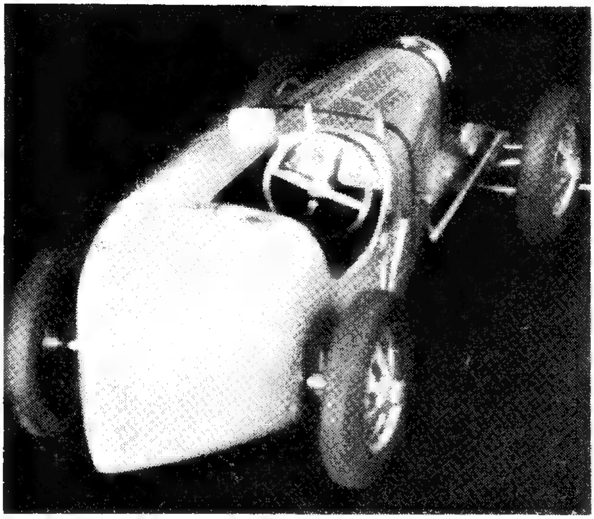
The cheek plates are simply light alloy discs. drilled ¼-in. diameter in the centre to fit over the reduced ends of the spindles, which hold them in place on the spool arms. A sectional view of the complete assembly is shown herewith. The spools should turn freely, but with just sufficient friction, provided by the spring ball, to prevent them from turning if the film has a tendency to unwind. Location endwise should be quite positive, but removal of the spool should not require much force; the best method is to pull on the rim of the spool with the thumb and second finger while pressing on the end of the spindle with the tip of the forefinger.

(*To be continued*)

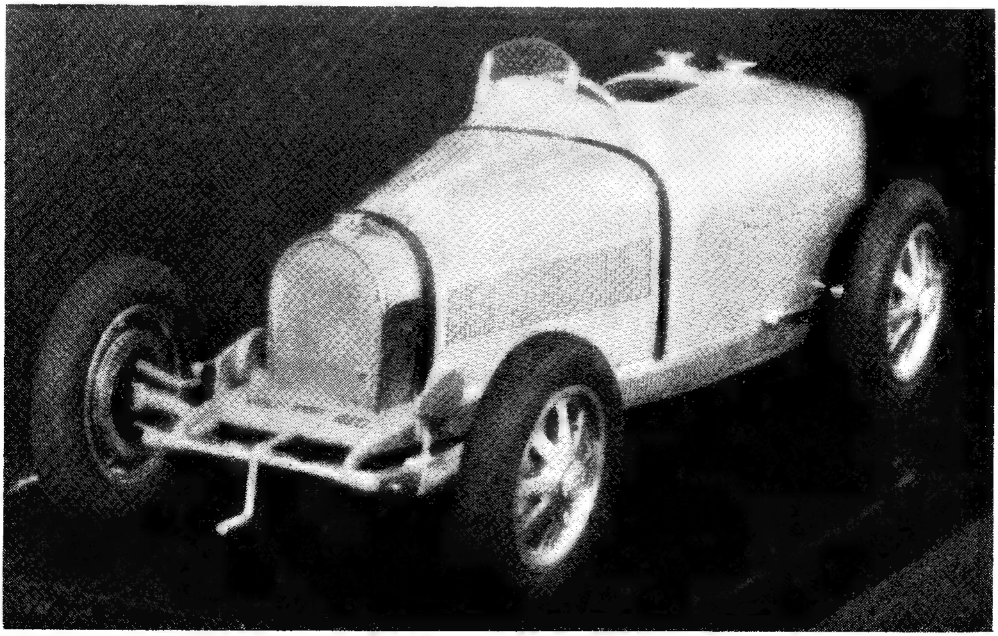
A 1/24th Scale Type 51 Bugatti

by C. Posthumus

MINGLE with any gathering of motor racing fans at a British speed venue and mark the reverence with which they speak of that superb creation, the Bugatti car. The very name has an aura about it, a redolence of countless exciting motor races between the wars, when the famous blue machines dominated the European circuits year after year, and drivers such as Materassi, Constantini, Divo, Chiron, Varzi, Williams, etc., ranked highest on the merit sheets. Of all the racing Bugattis perhaps the most successful and appealing was the type 51 Grand Prix car, with twin o.h.c. 8-cylinder engine, first introduced in 1931. " . . . Aesthetically, most racing enthusiasts agree that the Grand Prix Bugatti is nigh on perfection . . . " said D. S. Jenkinson in *The Model Car News*, August, 1947, and certainly few machines could be more inspiring—inspiring in performance, as its wonderful record shows; inspiring to drive, for its exquisite design assures perfect handling; inspiring to behold, in its compact beauty, balanced lines and fine finish; and inspiring to model . . .



The type 51 Bugatti offers not only these subtle, abstract inducements to the "solid" modeller, but has practical advantages too, for its clean design permits the omission of major features such as the chassis frame and rear springs, on the quite legitimate grounds that these are concealed within the shapely body, thus materially reducing the amount of work to be done. The 1/24th scale type

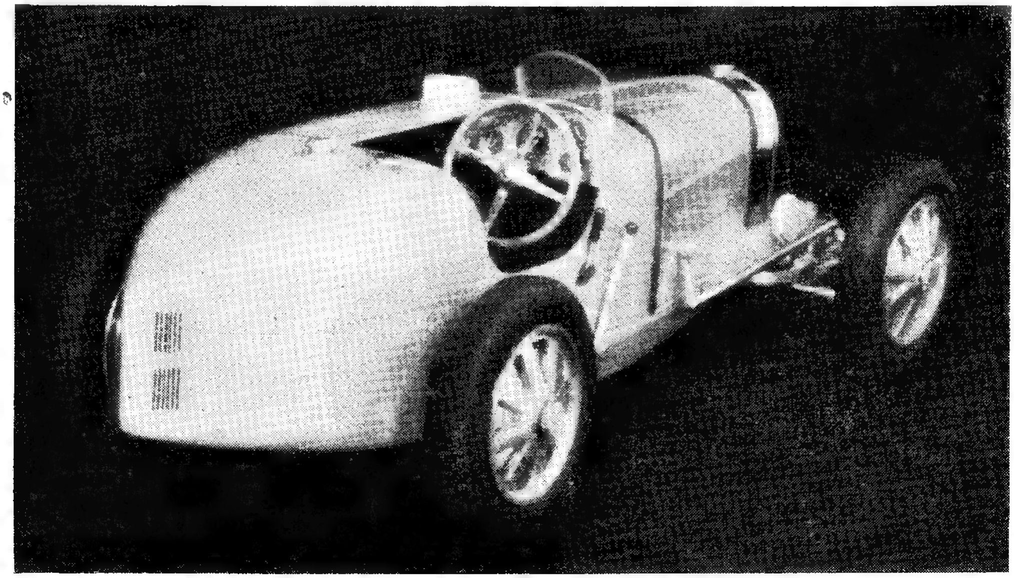


51 model shown was a "rush" job, completed in under a fortnight from *The Model Car News* drawings in the August, 1947, issue, these being photostated up to 1/24 th. scale. Basically, the model comprises a one-piece solid wooden body with separate plated brass radiator and stone guard, a fully detailed front axle, springs and fore-end of the chassis, a plain rear axle, and four wheels.

After initially shaping the body from a piece of obeche wood, the cockpit area was cut completely away to floor level, a nickel-silver instrument panel mounted at the aft end of the scuttle, and plywood cockpit side-pieces set in. The front axle was formed from nickel-silver rod, threaded 8 B.A. at the ends, and soldered into the forked centres of the semi-elliptic springs, which were filed from solid brass. The chassis side-members, filed out from 3/32-in. brass plate and suitably cross-braced to form a unit, extend back a little beyond the point at which, on the prototype, they disappear into the body—i.e., approximately a scale 1 ft. behind the radiator. Channels were cut into the body base to accommodate these members and small woodscrews secured them to the body, with plastic wood finally sealing the open channels. The rear axle is a nickel-silver spindle of 3/32 in. diameter, taper turned towards the ends, which are threaded 8 B.A., and running in a simple metal "double bracket" mounted in a ½ in. wide slot cut in the base of the body, aft of the cockpit. A length of 3/32 in. bore tube, slid over the axle and pinned thereto, locates the latter between the bracket ends. Both front and rear axles have brake backplates of thin gauge brass sheet, tapped 8 B.A. to screw up to the ends of the threaded portion of the axles, being set in place with solder. The rotating wheels run against these plates, being retained on the axles by nickel silver hubcaps soldered flush with the tips.

The wheels were turned on the lathe in brass, the rim, spokes and hub portions being integral, with separate brake drum ultimately sweated to the inside. After turning the wheel blanks, the eight spokes were marked out and the interstices drilled and filed away carefully. This was a tedious job at first, but once having "got into the groove" the four wheels were completed in a gratifyingly short time. To sweat the brake drums to the inside of the wheels entailed mounting both on a locating pin. For this I used the shank end of the No. 43 drill used to make the 8 B.A. clearance holes in the hub centres of wheel and drum, graphiting it all over carefully so that molten solder would not stick, then mounting it vertically in a machine-vice with flat-topped jaws. Wheel and drum rested firmly on these, so after tinning both on the contacting faces, they were mounted on the pin, when a large hot soldering iron, pressed firmly down, soon heated the two sufficiently for the tinning to run and thus unite them concentrically.

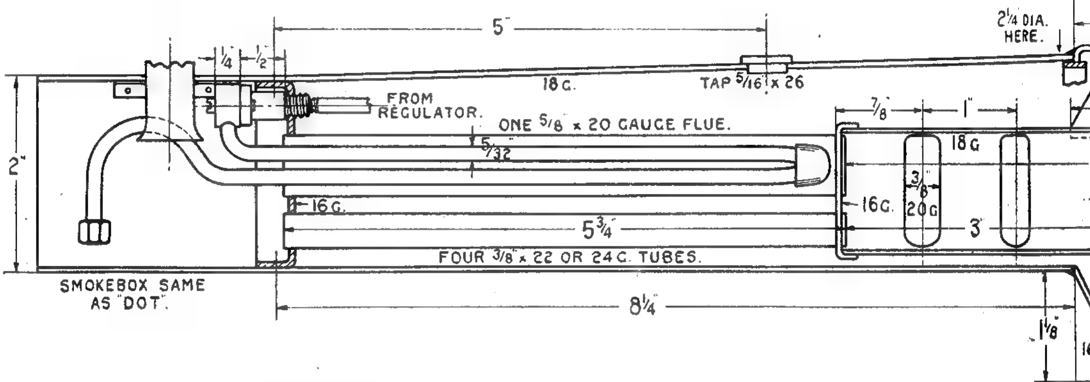
The finished wheels were then dull-plated to resemble the actual alloy used. The tyres were Simanco rings, suitably modified in the lathe and finished off with durable fine emery-cloth. The axle assemblies, steering connections and twin filler caps were all plated. The body, chassis and springs were finished with Naylor's Brushing Belco cellulose paint, primarily selected for its near-perfect Bugatti shade of blue. Unlike many cellulose finishes, Belco does not dry within bare seconds of applying, but allows one time to breathe during a rather tense operation, while its endearing ability to even itself out ensures that no annoying brushmarks will mar the smoothness of the surface.



A three-quarter rear view, showing cockpit, steering wheel, etc. The mirror was a piece of buffed nickel-silver, soldered in place and "faired" with plastic wood

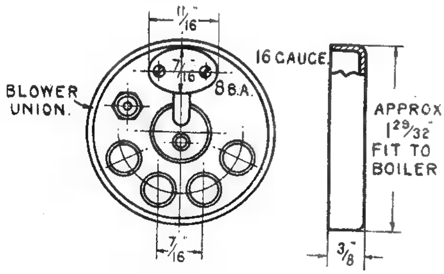
"Diana"—A Coal-Fired Version of the '

ALTHOUGH this boiler was schemed out especially for those builders who wanted ■ coal-fired edition of the "wee *Dot* like *Doris*," it can be adapted practically to any type of Gauge "1" engine with a wide firebox; and so should supply the answer to those correspondents who have written to me asking for details of a coal-fired boiler suitable for Gauge "1" Pacifics by aid of the usual pan of coke or breeze. Incidentally, a beginner recently wrote me and asked what size blowlamp would I recommend for brazing up ■ 3½-in. gauge Pacific boiler without the need of a pan of coke, as he wanted to do the job indoors, and was afraid of the effects of the fumes from burning coke. Well, I just told him that he would need a lamp giving a flame big



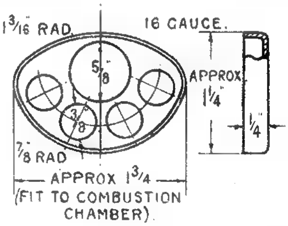
Longitudinal section and cross section at firebox of boiler for "Diana"

of L.M.S. and L.N.E.R. outline. Simply put the firebox, combustion chamber, and tubes into the shell of any particular type you fancy; you'll get the steam all right! Small variations in size, won't have any adverse effect, as long as the general arrangement of the whole doings is as shown in the illustrations. The firebox and



Smokebox tubeplate

other internals will fit inside ■ round-topped wrapper sheet, and it doesn't matter a bean if the boiler barrel is parallel, or of larger diameter. The construction is pretty much the same as described for larger engines, such as *Hielan' Lassie* but the job is naturally much easier to heat up, and keep hot; ■ 2½-pint blowlamp, or equivalent gas blowpipe, should do the needful quite easily, enough to envelop the whole boiler; I didn't think such ■ lamp was made commercially, but if it were, personally, I shouldn't care to operate such ■ fearsome weapon indoors. I still recollect when the vaporiser of a five-pint surplus lamp burst in the bathroom at my old home at Norbury, when I was doing a job indoors—against my will—



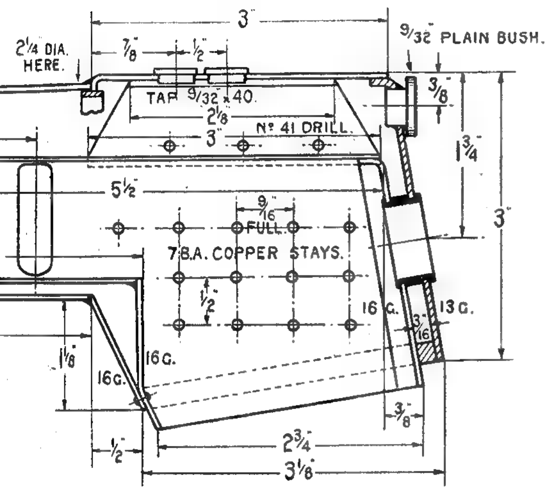
Combustion chamber tubeplate

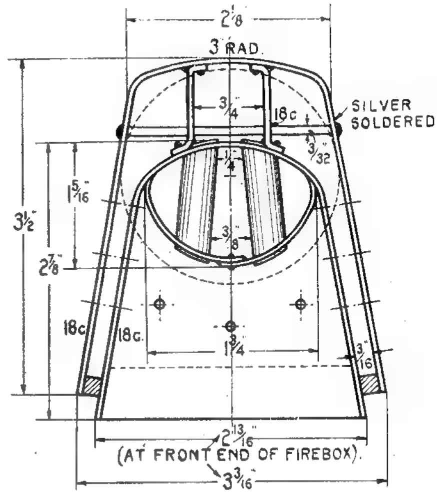
because it was raining cats and dogs outside, and the boiler was urgently needed. It was the nearest I ever got to ■ hospital job during my whole experience of locomotive work, both big and little. May I remind beginners that the best time and place to do your boiler-brazing, is in the back garden, on a fine evening, just as dusk is falling. You don't become three-parts roasted, nor half gassed with coke fumes, and you can see the brazing material running, ever so much

the "Wee Dot Like Doris" by "L.B.S.C."

easier than in bright daylight. That was my usual practice in days gone by, before I went in for oxy-acetylene equipment ; and experience teaches. Also, never do any brazing, silver-soldering, or even soft-soldering, in your workshop, or you'll have all bright parts of tools and machinery go as rusty as an old horse-shoe in no time.

$\frac{1}{4}$-in. steel or iron plate, less $\frac{1}{16}$ in. all around the inside measurement of backhead and throat-plate (measure from the cross section at firebox), then flange the plates over it, as described for previous engines. Cut a hole in the throatplate $2\frac{1}{8}$-in. full diameter ; rivet the throatplate in place with a few $\frac{1}{16}$-in. copper rivets, fit a " piston-ring " in the hole (strip of copper sheet about





How to Build Up the Outer Shell

Now let's make a brief run through the construction. Soft copper sheet of 18-gauge will be just right for the barrel and firebox wrapper. There isn't the slightest need to bother about marking out the sheet for the taper barrel, by the geometric methods set out in the text-book ; life's too short ! Just cut a piece of sheet copper about $8\frac{1}{2}$ in. long, $7\frac{1}{4}$ in. wide at one end, and $6\frac{1}{2}$ in. at the other ; that is, tapering $\frac{3}{8}$ in. each side. Bend this around anything handy, of suitable size, letting the edges overlap until the smaller end is 2 in. across, and the larger end $2\frac{1}{4}$ in. ; put a few $\frac{1}{16}$-in. copper rivets in the seam, to make it " stay put " whilst being brazed. File off each end square with the seamed side, so that when erected, the seam will be underneath, level, and parallel with top of frame, whilst the top of the barrel slopes $\frac{1}{4}$ in. from smokebox end to firebox end. A try-square applied to the bottom, will show at a glance if the ends are square with the bottom.

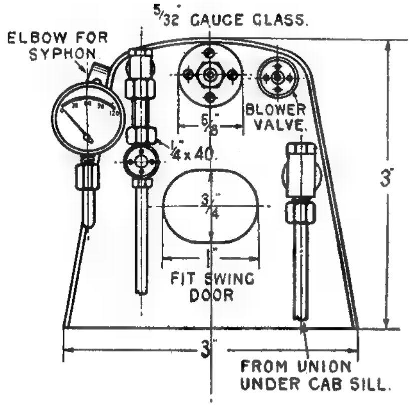
The wrapper sheet of the firebox can also be cut from 18-gauge copper, and shouldn't be any trouble to bend over a bit of rod projecting from the side of the jaws of the bench vice. Start with a piece $8\frac{1}{2}$ in. by $3\frac{3}{8}$ in., bend to shape, then trim up each end to form the slopes of backhead and throatplate. One former will do for both of these ; make it from a bit of

$\frac{1}{4}$ in. wide, bent into a ring) and fit the barrel over the ring. Then go ahead and braze up, as described for *Doris*. Stand the lot on end in the coke, barrel pointing to the stars, smear some wet flux around barrel and throatplate joints, pile up coke or breeze all around, almost to level of joint, heat to red, concentrate lamp flame on one corner, then when bright red, apply the easy-running brazing strip and work your way, inch by inch, steadily around the whole issue, feeding in the strip to form a neat fillet all around the barrel, and filling up the groove between throatplate and wrapper. There shouldn't be the slightest difficulty in this small boiler, in getting the brazing material to flow almost like water, and run perfectly without forming lumps of " almond rock " in the joints. Any beginner who has only a one-pint lamp or a small gas blowpipe, could use a coarse grade of silver-solder, such as Johnson-Matthey's B6 alloy. This costs more than easy-running strip, but is not too expensive. Warning to beginners : When I say *small* gas blowpipe, I'm not referring to the tiny things sold for half-a-crown or thereabouts, under fancy names. They are all right for little things like fittings, union cones and suchlike, but utterly useless for boiler-work. When the above job is done, lay the shell on its back in the pan, and do the longitudinal seam, being careful to cover the rivet heads ; then

pickle, wash off in running water, and clean up with a handful of steel wool. Clean copper is much nicer to handle!

Firebox and Combustion-Chamber

Firebox and combustion-chamber are cut from a single sheet of 18-gauge copper, roughly 7 in. by 6 in. The diagram shows how to cut it. First bend the whole lot into the shape shown in the cross section; then carry on with the 3-in. part until the ends overlap, and the shape is as shown. Put three or four rivets in the joint, to hold it whilst brazing. Fill up the gap under the combustion chamber with a piece of $\frac{1}{16}$-in. sheet copper, flanged over each side, bent at bottom as shown, and riveted in place. The door-plate is a small edition of the boiler backhead, made from 16-gauge copper and riveted in position. The firehole ring is made from a piece of 1-in. by $\frac{1}{8}$-in. copper tube, with a step turned at each side of it, and then squeezed oval. The



The backhead

step on one side is pushed through a hole in the door-plate, cut to receive it, at position shown; and the lip is hammered down on the flange side of the plate. Fit two 16-gauge top girders as shown.

The combustion-chamber tubeplate is knocked up from a bit of 16-gauge copper sheet, and drilled as shown; it fits over the end of the chamber like the lid of a coffee-tin. Four $\frac{3}{8}$-in. by 22-gauge water-tube struts are fitted to the combustion-chamber, as shown. Leave plenty of length on these when fitting, and slightly countersink the holes. Then braze up the whole issue at one heat, running a good fillet of brazing material around the water-tubes and the firehole ring. The melted metal should also fill up the grooves between end plates and firebox sides; also leave a fillet where the little throatplate joins the underside of the combustion-chamber, and at each side of the roof girders. A little silver-solder may, if desired, be run under the girder flanges, to make certain that the contact is perfect, and that the flanges cannot pull away from the firebox crown. This also makes a certainty of sealing the rivets.

The smokebox tubeplate is merely a circular edition of the one on the combustion-chamber, but as it fits inside the end of the barrel, turn the outside of the flange to a tight fit. The inside of the barrel should be filed a wee bit, to bring it parallel; the tubeplate only goes in for half the width of the flange, as the projecting part is used for mounting the smokebox (see illustration) The four tubes are $\frac{3}{8}$-in. diameter, and $5\frac{3}{4}$ in. long. If you are fairly experienced at boiler-smithing, use 24-gauge tubes, but if a raw recruit, use 22-gauge; you won't be so liable to burn the metal. The superheater flue is $\frac{5}{8}$ in. by 20 gauge. Clean the ends with coarse emery-cloth; the more you scratch it, the better the silver-solder will "take." Fit the tubes into the end plate of the combustion-chamber, set them level and parallel with it, and put the smokebox tubeplate on the outer end, to act as spacer and support whilst silver-soldering. Smear some wet flux around the tubes; and if you are using sheet silver-solder, cut a few tiny $\frac{1}{8}$-in. squares and put a couple at each tube. Blow the lot to bright red, and the silver-solder will melt, "flash" around the tubes and form a perfect seal. This is usually denoted by a silvery ring showing around each tube, on the inside of the tubeplate. Before pickling, pull off the smokebox tubeplate, and heat the tube ends to dull red, to soften them for the expanding process; then pickle the lot, and wash off.

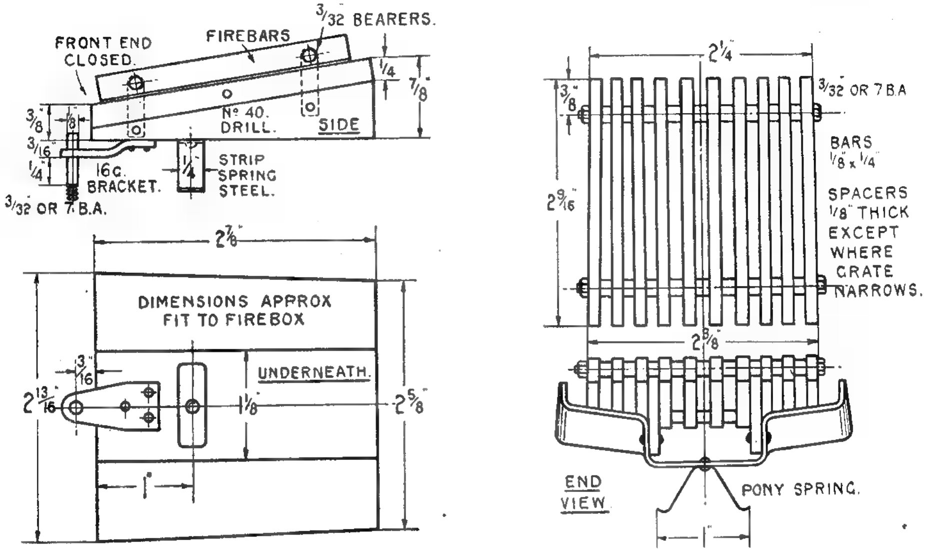
First Stage of Assembly

All contact surfaces should be cleaned with coarse emery-cloth or other abrasive, and the projecting bits of water-tubes filed flush with the combustion-chamber. Then slide the firebox-and-tube assembly into the shell; see that the firebox is central with the wrapper, and put three or four $\frac{1}{16}$-in. copper rivets through the joint where the two throatplates meet (see illustration). If the tops of the crown-stay girders are hard up against the inside of the wrapper sheet, let them bide; if not, put a couple of rivets in to hold them in contact whilst silver-soldering. Next, fit the smokebox tubeplate, flange outwards as shown; the tubes can be guided through the holes by aid of a wooden meat skewer, knitting needle, or blacklead pencil. When the flange is halfway in, the tubes should be about 1/32 in. through. Expand them by driving something taper, such as a drill shank, into the ends; if greased, it will come out easily. The joints can then be silver-soldered. Use a coarse grade of solder and a good borax flux, such as "Tenacity No. 1," mixed to a paste with water; with a $2\frac{1}{2}$-pint lamp, no coke packing will be needed for this job. Just lay the boiler in the coke in the pan, heat up the end, run a little silver-solder into that part of the flange joint which is uppermost, and turn the boiler over to do the other side. Stand it on end to do the tube ends; use best-grade silver-solder, or "Easyflo" for these. Then turn the boiler on its back, with the firebox overhanging the edge of the pan, and run some silver-solder along the joints between flanges and wrapper. If you flux the joints, and lay a strip of silver-solder alongside each flange, a good hefty blow from underneath, outside of the wrapper, should heat the whole issue to a medium red, and make the silver-solder melt and

sweat clean through each joint. If you have a smaller blowlamp as well, get that going, and play on the girders with the flame, at the same time. The job will then be just a cakewalk. Let cool to black before putting the job in the pickle ; and beginners especially note—*mind the splashes.* If any splashes get on your skin, wash off immediately, or you'll get the itch without wanting to build a *Tich* ; and if your clothes get splashed, liquid ammonia (as used for washing) is a good antidote, and may save patronising CC41.

pany whilst the final silver-soldering is going on. Three 3/32-in. copper wire stays pass through plain holes in the wrapper, and are riveted over at each side, as shown in the cross section.

Fill in the gaps between firebox, wrapper, and backhead, with pieces of $\frac{3}{16}$-in. soft square copper rod, well cleaned, holding them in place by three or four $\frac{1}{16}$-in. copper rivets in each. Drill the holes in the barrel for dome and safety valve bushes, and fit bushes turned from thick copper tube, or copper rod ; failing that, bronze



Grate and ashpan

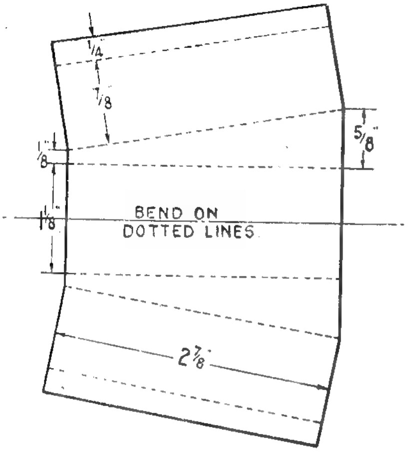
Backhead and Foundation Ring

The backhead is knocked up from 13-gauge (3/32-in.) copper. If this thickness is used, there will be no need for putting in bushes for the fittings, with the exception of the regulator. This needs a bush, as it must go in parallel with the top of the firebox wrapper ; the bush is $\frac{5}{8}$ in. diameter with a 9/32 in. clearing hole in it. The illustration shows how it is fitted. The position of the firehole is obtained from the boiler itself, measuring from firehole ring to top and sides of wrapper, and transferring the measurements to the backhead. I have stressed many times, to cut the hole a bit undersize at first, then try the backhead in place, and file the hole as indicated by the flange. When you get it in correct position, put the backhead in place " for keeps," and flange out the lip of the firehole ring, where it projects through, hammering it down into close contact with the backhead. Beginners note that this forms a nobby stay to the door-plate of the firebox. If the sides of the wrapper won't keep tightly in contact with the backhead flange, hold them in place with a clamp, or in the bench vice, and put a few stubs of 3/32-in. copper wire, screwed 3/32 in. or 7 B.A. through wrapper and flange. That will teach them manners, and they won't part com-

or good gunmetal. Brass bushes are liable to melt. Maybe our approved advertisers would supply small pieces of cast copper, or the metal used in plumbers' weldable fittings, as used in modern copper all-welded plumbing. When our old friend, Mr. H. C. Sturla, was running his foundry at Waltham Cross (the foundry is still in active operation, though " Bro. Smiler " has long since retired), he gave me much valuable information about the composition of various alloys. There are hundreds of grades, and I honestly believe he knows every one by heart ! What was more valuable still, he used to give me sticks of metal, of the absolutely correct grade for any purpose I required ; and even at the present time, I still have sufficient of his cast copper stick metal, to turn quite a lot of boiler bushes. Most of my locomotives have pistons turned from his special bronze—maybe that is why they go for years without attention, and never let a whiff of steam get by !

On this wee boiler, silver-solder can be used for the final braze-up, and as it is the last operation in that line, best grade can be used. I recommend " Easyflo " and the special flux sold for use with it ; not because I've any shares in the firm of Johnson-Matthey (I wish I had ! !) but because I use the stuff myself, and find it

absolutely the "cat's whiskers." One of the reasons why my little boiler fittings look like jewellery jobs, is because they are silver-soldered with "Easyflo" wire. The job is done in the same way that I have fully detailed out for larger boilers. Put the boiler on its back in the coke, after covering all joints with wet flux, and pile the coke around it almost level with the foundation ring. Put a bit of asbestos millboard inside the firebox, to protect the combustion chamber



How to cut and bend ashpan

and tubes. Then get busy with the blowlamp. Use two, if you have them, getting a mate (even a kiddy will do) to play the flame of No. 2, along with your own, on the opposite side of the joint, catching same literally "between two fires." After a preliminary heating, start concentrating on one corner, and when that is hot enough to melt the strip of silver-solder when applied, work all around, inch by inch. Then up-end the boiler and do the backhead flange and firehole ring; finally run a fillet around the bushes and the heads of the wire wrapper stays. When it cools to black, be careful how you put it in the pickle, as it is now fairly heavy; and when the acid runs inside for the first time, it usually emulates a geyser or a whale. Let it stay in the pickle for 20 to 30 minutes; then fish it out, drain well, wash in running water, and clean up. I have already explained how to test for "pinholes," and what to do if you find any.

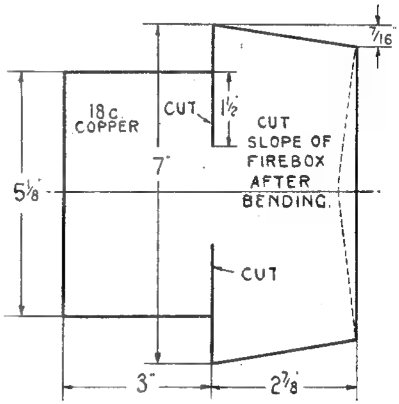
Staying

With the construction, and thickness of metal specified, there won't be any need of either longitudinal stays, or screwed cross stays in the firebox wrapper; and with the spacing shown, only 3/32-in. or 7-B.A. stays will be needed in the firebox. As the combined thickness of wrapper and firebox sheets, plus the water space, is less than $\frac{5}{16}$ in., ordinary taper and second taps will do the trick, and no special tap is needed. Tip for beginners: wet the No. 48 drill, and the taps, with cutting oil before using; this makes for clean threads. The die should also be treated to a dose of the same medicine when screwing the 3/32-in. copper wire used for stay bolts. Directions for stay-making and fitting have been given umpteen times already. Screw the bits of wire for about $\frac{7}{16}$ in. length, and screw right home through the holes in wrapper. Use ordinary commercial brass nuts, and any thread projecting beyond, may be snipped off close to the nut. This will become burred when riveting over the outer ends of the stays, and the nuts will be unable to slack back. The throatplate stays should be put in parallel with the boiler barrel, so that the nuts lock up squarely against the firebox front plate.

Sweat over the stayheads and nuts by heating the boiler to the melting point of soft solder, and then brushing the liquid solder all over the inside of the firebox, using plenty of liquid flux; not paste flux on any account. The outside can be done in the same way. Be careful to well wash away all traces of the soldering fluid, or the copper will turn green and show signs of corrosion. The boiler can then be tested by water pressure, to 160 lb. in exactly the way described for larger boilers.

Grate and Ashpan

As the notes on this little boiler have panned out a shade longer than anticipated, I will, all being well, deal with the differences in the fittings and mountings, in a following final instalment, showing a suitable feed-pump at the same time; meanwhile, builders can make the grate and ashpan. The grate is composed



How to cut out firebox and combustion chamber

of ten $\frac{1}{4}$-in. by $\frac{1}{8}$-in. firebars, mounted on 3/32-in. bearers, the spacers being 7/32-in. washers, $\frac{1}{8}$-in. thick, drilled No. 40. Four or six of the spacers at one end of the grate should be a little thinner, as the grate should taper $\frac{1}{8}$ in., to suit the firebox. Maybe our approved advertisers will supply a cast grate; I have received some excellent samples of grates for other engines, from our Scottish friend "Wilwau."

A diagram is given of the ashpan "in the flat." If this is cut from 20-gauge sheet steel, and bent

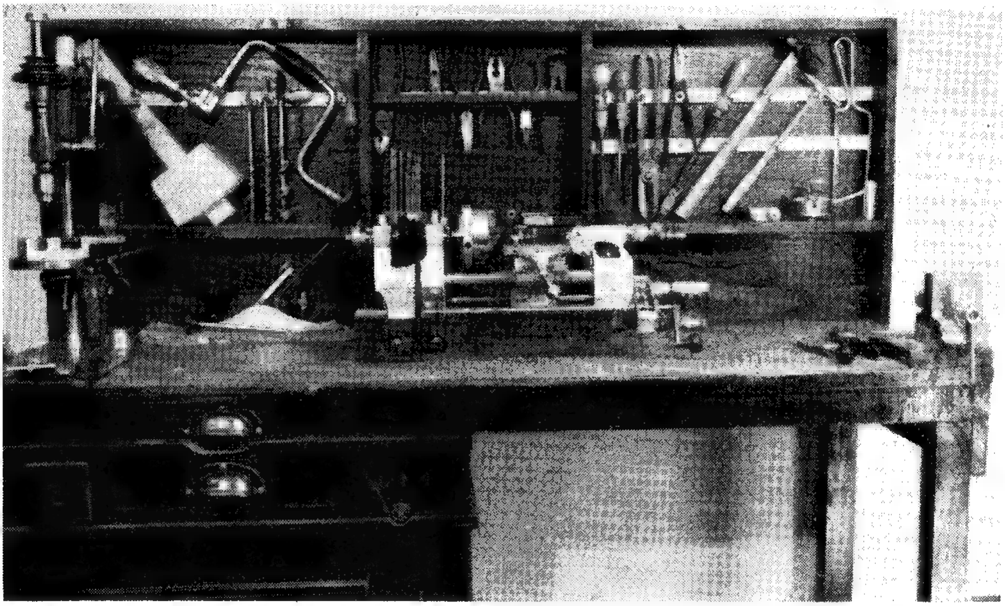
(*Continued on page* 523)

A Small Instrument Lathe for Home Construction

by E. G. Lewis, M.A.

I FIRST equipped myself with a workshop in those barely remembered days before 1939 when a 3-in. B.G.S.C. lathe could be purchased for £5 new, and with motor and all accessories for about £10. When, however, I could no longer transfer my workshop about the country fast enough to keep pace with wartime movements, I unwisely sold the lot, thinking to set up again with Government surplus machine-tools when stability returned at the end of the war. Alas, like many others I have been disappointed; Government surplus machine tools of small size have been almost non-existent, and new machines at fantastic prices, while, as to a stable abode, there still seems to be no peace for the wicked, and mobility is still the order of the day. Meanwhile my interests have turned more to instrument work, and so, not to be beaten by circumstances, I have turned to miniaturisation as the solution of my troubles.

The workshop I have recently built is entirely portable and self-contained, not, I think, offensive to the eye in a living room, and as near sound- and vibration-proof (for use in an upstairs flat) as I know how to make. It comprises a bench, mounted on six feet, each of which is bored up 1 in. diameter for a short way to accommodate a hard rubber bung which is left just proud of the woodwork, so reducing the transmission of sound to the floor. As shown in the photograph, the bench-top is linoleum covered and mounts a commercial $\frac{1}{4}$-in. H.S. drilling machine one end, a small vice at the other, and the lathe itself on a wooden stand in the centre. The rack behind carries, as can be seen, all the hand tools in constant use.



General view of workbench and small instrument lathe

The pedestal, which forms the left-hand half of the bench, contains, besides two drawers for fine tools, a cupboard housing the motor and countershaft. The motor, a $\frac{1}{4}$-h.p. split-phase with resilient mounting, is fixed to a baseboard together with pedestal bearings supporting a short $\frac{1}{2}$ in. diameter countershaft, which carries at its left-hand end the three-step vee-pulley for the $\frac{1}{4}$-in. round belt drive to the drilling machine. The $\frac{5}{8}$-in. wide flat belt drive from the motor is moved by a belt striking gear into one of three positions. In its left-hand position it drives the countershaft and thus the drilling machine; in the centre positions it runs idly on a loose pulley, actually a large ball-bearing; and in the right-hand position it drives a pair of pulleys—a flat pulley and a small pulley for a vee-belt—which revolve together on a bronze bush on the countershaft. This vee-belt pulley running at about 1,200 r.p.m. drives an 8-in. pulley on the

lathe countershaft at about 350 r.p.m. This motor and countershaft unit is not fixed rigidly to the bench, as this would transmit too much sound ; but the cupboard is lined with thick felt (even the inside of the cupboard door) and the baseboard carrying motor and drive, rests by its four rubber feet on this soft lining. A felt-covered ramp at the back of the cupboard and ■ rubber buffer at the front prevent the unit being lifted by belt tension. The belt-shifting gear is operated remotely by ■ two-way Bowden cable ; the control is fitted into a recess in the woodwork just above the cupboard door and to the right, matching the motor switch in ■ similar position on the left. This ensures that the motor is very quiet in operation, the only sound escaping being via the slots in the bench-top necessary for the belt drives.

In designing the lathe itself I made ■ compromise between the orthodox watchmaker's lathe which was rather too small for my requirements and the smallest engineer's lathe which is not suitable for home construction without a great deal of outside help. I could only count on occasional access to ■ larger lathe, so that the construction had to be such as could be carried out for the most part with hand tools and a drilling machine.

Since I required to have ■ saddle traversed by a leadscrew, I decided that the round bar with keyway (or flat) of the usual watchmaker's lathe would not give sufficient accuracy, and I adopted ■ bed consisting of two bars, ■ $\frac{3}{4}$ in. diameter ground steel bar to take the main stresses, with ■ 1 in. × $\frac{1}{4}$ in. C.R.S. bar, carefully scraped to flatness and parallelism on the edges, mounted vertically beneath it, to prevent rotation of the saddle. This method of construction has the virtue that the two bars can be mounted some distance apart, thus increasing the stability of the saddle, and by placing the leadscrew between the two bars, it is made to act symmetrically on the saddle, as well as being protected to some extent from swarf.

The capacity of the lathe was fixed by the size of the aluminium alloy chunks available (it was the possession of these, a relic of my prewar scrap-box, which suggested the lathe in the first place) and the available length of ground steel bar. This limited the height of centres to 46 mm. with 110 mm. between centres, which seemed adequate. The largest clock-wheel I could foresee having to turn would be $3\frac{1}{2}$ in. diameter, and the arbors would all be quite short.

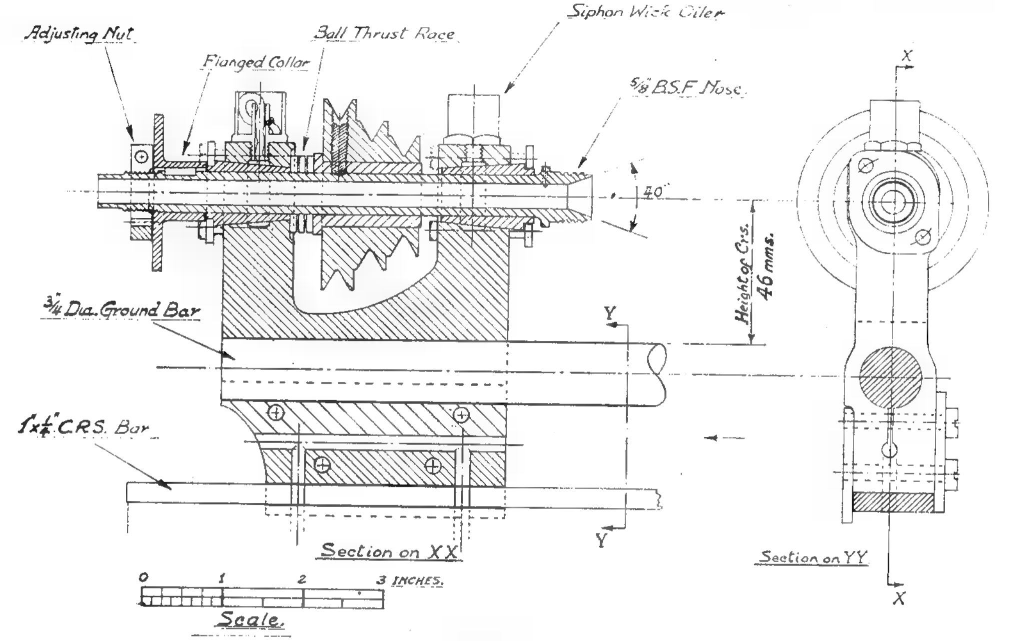


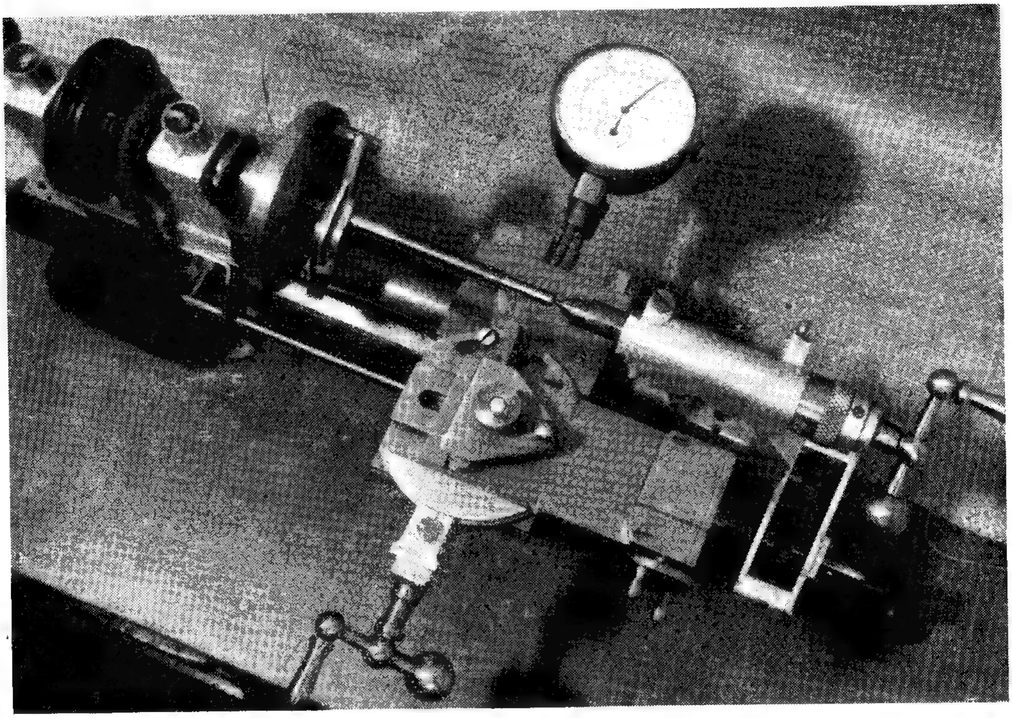
Fig. 1

The Alignment Problem—Headstock and Tailstock

The construction of the headstock is shown in Fig. 1. It will be seen to consist of ■ rectangular block of aluminium alloy $4\frac{1}{4}$ in. × $3\frac{1}{2}$ in. × $1\frac{1}{8}$ in., whose faces were reasonably true and square with each other. The problem was how to bore the headstock bearings and the tunnel for the $\frac{3}{4}$-in. ground bar in strict parallelism, and how further to attach the rectangular bar for the bed rigidly to the headstock in perfect alignment with the round bar. Since the rectangular bar is only required to contact the saddle and tailstock by its narrow vertical edges, it is only necessary to be perfectly parallel to the round bar when viewed in plan.

The following scheme was therefore adopted. The headstock was roughly shaped by drilling, sawing and filing, which was hard work, as the

material was tough, probably duralumin. Two faces were left as reference planes, one the back face of the headstock as viewed in Fig. 1, the other being the rear face of the block when viewed from the mandrel nose. These faces were filed and scraped to be flat and perpendicular to each other and to the bottom face of the block as shown in Fig. 2 (1) and (2). The block was now set up on an angle-plate on the faceplate of the block, below the tunnel for the round bar, was reduced in thickness from 1⅛ in. to 1 in. dead, by removal of metal from the front of the headstock only. By clamping the rectangular bar between steel cheeks as shown it is accurately aligned with the headstock (in the horizontal plane), while 2-B.A. studs and nuts (not shown) hold the rectangular bar rigidly against the underside of the headstock block (and therefore



Turning between centres, using dial gauge to regulate cross feed

as shown in Fig. 2 (3), making sure that the two reference planes were in contact with angle-plate and faceplate until in position for drilling and reaming the tunnel for the ¾ in. diameter ground bar, as sketched in Fig. 2 (4). Now without moving the angle plate, the block is moved into the position necessary for boring the headstock bearings, and so long as the reference faces of the block are in firm contact with angle-plate and faceplate, the axis of the bearings must be parallel to the bed.

The precise arrangement of the headstock bearings will be seen in Fig. 1. Since no grinding facilities were available, a hardened steel mandrel was out of the question, so it had to be a silver-steel mandrel running in split bronze bearings. To preserve concentricity these were made of conical pattern drawn by adjusting screws into conical seatings in the headstock. The 15 deg. tapered seatings were machined by the procedure outlined in the thumbnail sketches in Fig. 2 (5) and (6). The alignment of the 1-in. × ¼-in. bar was ensured very simply. The lower 1 1/16 in. approximately parallel, in the vertical plane, with round bar and mandrel).

The Mandrel

This, as shown in Fig. 1, is hollow to admit 5/16 in. diameter rod, is coned at 40 deg. included angle to receive 8 mm. watchmakers' collets, and the nose is screwed ⅝-in. B.S.F. with a registering spigot on each side of the threaded portion for faceplate and chucks. The mandrel was made from ¾-in. silver-steel which was turned parallel to ½ in. diameter for most of its length and polished. The ebonite cone-pulley which is fixed to the mandrel by a set-screw engaging in a depression in the mandrel, transmits the axial thrust through a ball-thrust race to the machined face of the rear headstock bearing housing, and endplay is taken up by a collar sliding on a feather-key, and moved axially by the 60 t.p.i. split adjusting nut. The collar has also been equipped with a flange on which can be mounted, if desired, a larger pulley to provide a slow speed drive in lieu of a back gear. A worm-whee

similarly keywayed, is also available, and it is intended to fit ■ dividing gear in this position later for cutting gear-wheels.

The draw-in spindle for the watchmaker's collets consists of a length of steel tube $\frac{5}{16}$ in. o.d., to which an ebonite handwheel has been fixed at one end, while the other is bored out truly and tapped $\frac{1}{4}$ in. $\times$ 40 t.p.i. for about $\frac{3}{4}$ in. The standard M.E. thread is too tight a fit for the standard collets which are apparently $6\frac{1}{2}$ mm. $\times$ 40 t.p.i., so that the internal thread has to be opened out a little for a length of $\frac{1}{2}$ in. with ■ 40 t.p.i., internal chaser. However, by leaving the remaining portion of the thread to the M.E. standard this is available for a good fit on to any home-made accessories (such as the headstock centre) if the threaded portion on these is left somewhat longer than on the commercially-made collets, and screwed with a standard M.E. die.

In addition to the watchmaker's collets, the mandrel is equipped with ■ small faceplate-cum-catchplate, a 3-in. lever-feed s.c. chuck and a $2\frac{1}{2}$-in. independent 4-jaw chuck.

The Tailstock

The tailstock, which is seen in the photographs and in Fig. 3, was similarly constructed from a flat and perpendicular to each other to form the required reference planes for the subsequent machining operations.

A $\frac{1}{4}$-in. diameter hole was now drilled at right-angles to the larger reference plane, and half in each of the two pieces of the tailstock. This hole was opened out by judicious filing to ■ square hole taking a $\frac{1}{4}$-in. sq. silver-steel key, which was attached by screws to the bottom part.

The two pieces of the tailstock block, keyed and bolted together, were now mounted on the angle-plate on the faceplate as has been described already in the case of the headstock. (The angle-plate was not moved between the two jobs, so ensuring an indentical relationship between the large reference plane, the round bed and the lathe axis, in the two cases.) The tunnel for the round bed was drilled out and reamed to $\frac{3}{4}$ in. diameter to be a firm sliding fit on the bar, and the block was then moved along on the angle-plate by ■ distance equal to $\frac{3}{8}$ in. plus the height of centres measured from the assembled headstock. The hole for the tailstock barrel was then drilled out and reamed to $\frac{1}{2}$ in. diameter. This hole was lapped to fit the barrel. After this the outside surfaces were turned or filed to shape and polished as required to give a pleasing outline to the

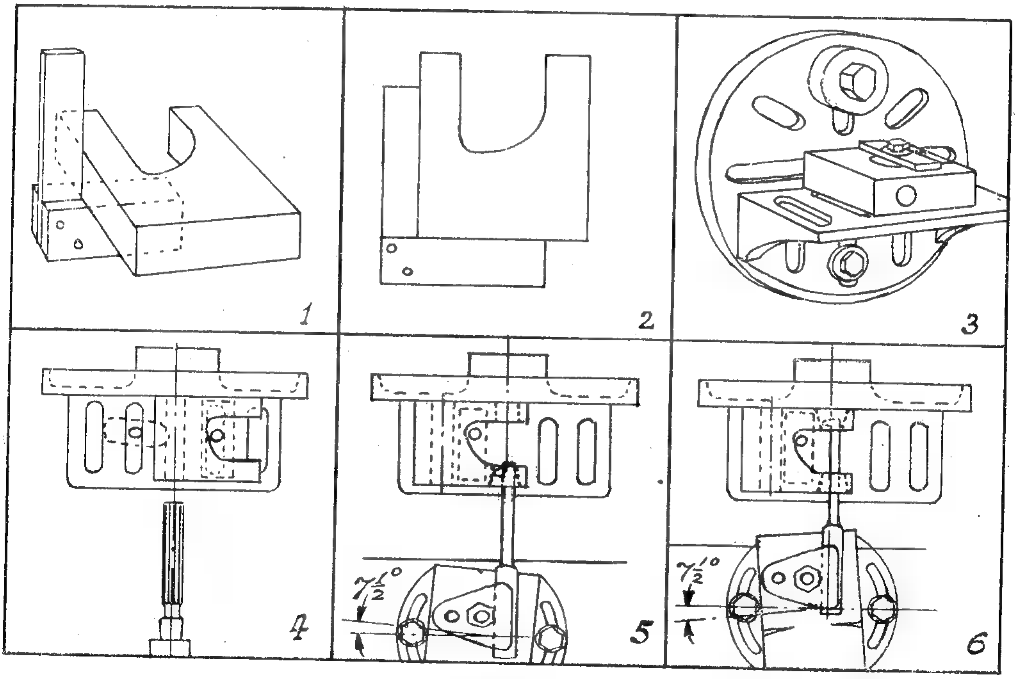


Fig. 2

block of the same light alloy as the headstock; but in this case the provision of a set-over arrangement necessitated splitting the block horizontally, and filing and scraping the two surfaces to mate accurately. The two halves were then bolted tightly together, and the back- and right-hand vertical surfaces of the single block so formed were filed and scraped to be tailstock. The hole in the top part, through which passed the $\frac{1}{4}$-in. stud attaching it to the bottom part, was extended laterally to give a slot allowing adjustment of the back centre in a horizontal plane for fine taper turning. The thickness, front to back, of the bottom part of the tailstock was reduced to 1 in., by filing down the front face as in the case of the headstock so that the steel

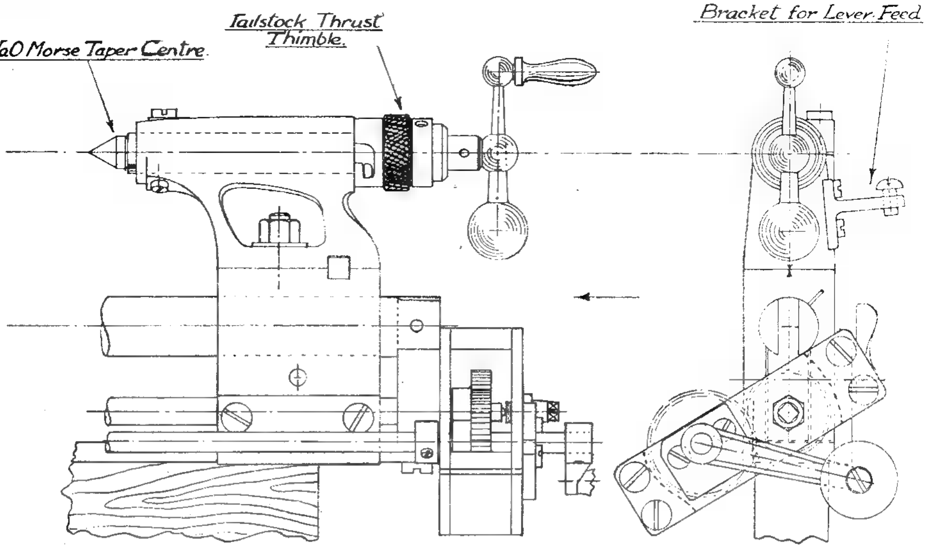


Fig. 3

cheeks could be fitted accurately embracing the rectangular guide bar of the bed.

However, in this case a radial saw-cut was provided out of the ⅞-in. diameter tunnel, and a locking screw and lever. The latter was arranged either to clamp the tailstock by moving the top of the lever towards the headstock, or to give a positive unlocking action on reverse movement by means of a small flange on the locking-screw trapped behind the rear cheek-plate.

Lever-feed or Screw-feed at Will

In a lathe of this "in-between" size it was felt that both screw-feed and lever-feed for the back poppet were called for, the former for drilling with twist drills of $\frac{1}{16}$ in. to ¼ in., and the latter for use with watchmaker's drills. For the screw-feed I prefer the pattern which employs an internally-threaded barrel, from which the centres or drills can be automatically ejected on withdrawal. This is, however, a type which I had never seen combined with a lever-feed movement; the design did not present any particular difficulty, as may be seen from Figs. 3 and 4 (*a*) and from the photograph.

(*To be continued*)

"L.B.S.C."

(*Continued from page* 518)

on the dotted lines, it will finish up as a hopper of the correct shape, size, and slope. Stand it on end, narrow end down, on a piece of the same kind of material, and braze the joint, using Boron compo or similar flux, and brass wire; trim to shape, The closed front end prevents ashes and grit getting at the working parts of the engine. At 1 in. from the front, a piece of spring steel (clock spring will do) is riveted to the ash-pan, and bent to the shape shown; the ends of this, bear on the cross stay of the pony truck, and take part of the weight of the trailing end of the engine. A bracket made from 16-gauge steel, cut out to shape shown, is riveted to the underside of the ashpan at the closed end; see side and underneath views. This carries the pony king-pin, made from ⅛-in. round steel, and brazed or silver-soldered in place. The lower part of the pin passes through the hole in the front member of the pony truck, and is nutted underneath. When the ashpan is in place, the upper part of the pin enters the blind hole in the rear cross-brace of the main frames, and transmits the pull, *via* the pony frame, to the drawbar, which is attached to the rear cross-brace of the pony frame. The ashpan is kept in position by a 3/32-in. pin, passing through a hole in each top flange, through corresponding holes in the projecting part of the firebox side sheets; an arrangement which works very well on one of my own engines. The grate is mounted on four legs attached to the ashpan, as clearly shown, so that the whole lot—grate, ashpan, and pony truck—are released by pulling out the pin.

A New Down-Draught Carburettor

for a 30-c.c. 2-Stroke I.C. Engine

by Richard O. Porter, M.B.E., T.D.

THE engine illustrated is venerable and was made from a set of Stuart Turner parts in 1921; probably it is the only one in existence and certainly the only one that has functioned after many major alterations. The original fuel arrangement, designed by S.T., was a hole in the seating of the automatic inlet-valve; S.T. would have called it a mixing-valve! The valve casing can be seen in the photographs, now inverted to suit the down-draught carburettor.

This engine is installed in my motor cruiser *Slickery*, registered at Victoria Park, a boat well known for reliable running at M.P.B.A. regattas and very often placed in steering competitions. For some 30 years the engine has had a normal carburettor with float chamber and gravity petrol feed. This was reliable, but subject to speed variations caused by occasional petrol flooding or starvation. Following a third "place" in steering at the "Grand Regatta" last August, I decided that I must remove all x's from this engine, and started to design a carburettor that would give constant speed under all conditions.

The result has been bench-tested satisfactorily and is illustrated in this article. I now have constant r.p.m. with constant m.e.p. The carburettor is a duralumin block about the size of a "lighter" and consists of a plain venturi-tube choke, 7/32 in., barrel throttle, and a small petrol well $\frac{3}{8}$ in. diameter and $1\frac{1}{2}$ in. deep (Fig. 1). The jet is adjustable and is inserted through the petrol well; the adjustment is set and was only made variable to facilitate bench tests. The barrel throttle is used to stop the engine, when closed, a small amount of petrol drips from the jet, rests on this throttle and acts as a priming charge when restarting. Petroil is filtered and pumped to the petrol well by a very small diaphragm pump actuated by crank-case compression (Fig. 2). This type of pump, I believe, was quite original to this engine, you will see on the right hand side of the engine a water pump of the same type, evolved from an old centrifugal

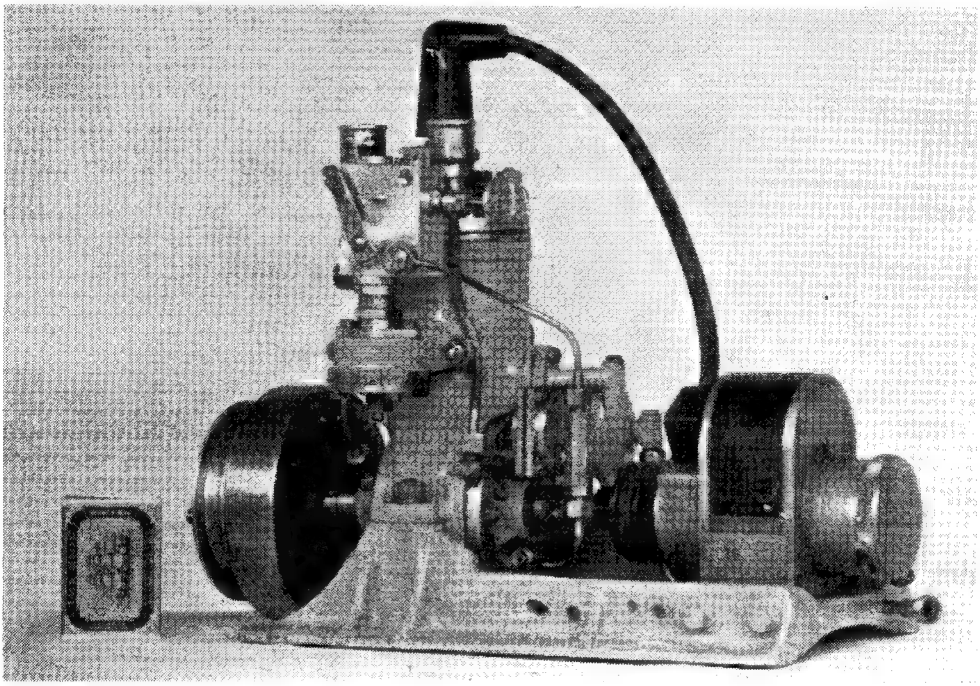


Photo by] [*Maurice Butler*

Petrol tank removed to show petrol and water circulating pumps

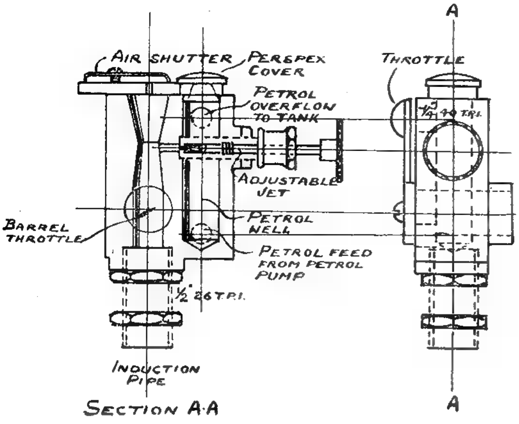


Fig. 1

pump casing ; this, except for renewal of leather diaphragms, has been trouble-free for some 25 years. Both pumps have a very modern petrol proof rubber diaphragm strengthened by insertion of glass fibre textile. The magneto is a German Eisemann, war disposal of 1914-18 vintage, the plug is a 14-mm. Champion. Main shaft is lubricated by grease, compression and r.p.m. are purposely very low.

Previous to 1939, this engine had on occasion run under load for six hours, during which time it towed a small punt eight miles on the River Thames. It remained unused during the recent war years, but in 1945 when I returned from the Middle East, the first thing I did was to put some petrol in the tank, and pull the starter, I was rewarded with an immediate response !

With the new carburettor, I expect this engine will run indefinitely and I hope, if transport is available, to figure very prominently in 1950 steering competitions and maybe, also in nomination events, if I can get the chance of a few runs over a measured course.

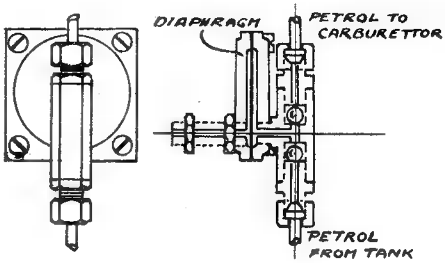


Fig. 2

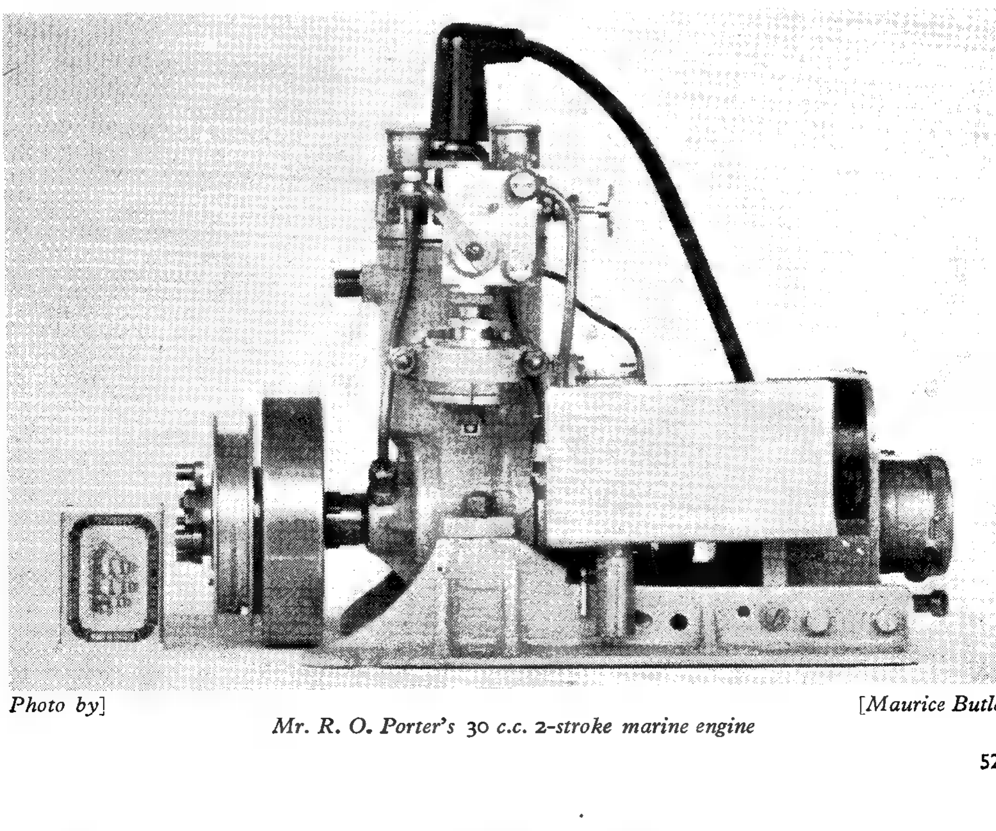


Photo by] [*Maurice Butler*

Mr. R. O. Porter's 30 c.c. 2-stroke marine engine

Novices' Corner

Turning with the Graver

THE hand graver, which is illustrated in Fig. 1, was at one time in general use as a turning tool. Nowadays, many people consider hand turning in metal to be beneath their dignity, or at least not worthy of serious consideration. This is not so, for the graver is a most useful tool for certain work. For example, it is often necessary to round the sharp corners on turned work. These can, of course, be machined with a radius tool, indeed, such tools are essential for accurate work. The radius tool is a turning tool which is held in the lathe tool-post and which has its cutting edge ground to the curve it is desired to reproduce on the work. For general purposes, however, and in circumstances involving no great accuracy, the use of the graver is amply justified. As will be seen from the illustration, the tool is made from a length of square section tool steel ground at 45 deg. to form a diamond-shaped point. The opposite end is drawn down so that ■ wooden handle can be fitted. The shape of the handle should be noted, for this form has been found the most comfortable.

Using the Graver for Turning Steel

Experience has shown that, for rounding corners on steel, it is best to hold the graver so that it makes contact with the work well above centre, taking ■ slicing cut, Fig. 2. The tool is held down on the hand-rest by the first finger and thumb of the left hand, and is rotated about its own axis by the right hand, the requisite motion being given by the wrist. The rest should be brought as close as possible to the work to avoid digging in, and the lathe run at a moderate speed. This last point needs stressing, for it is, apparently, not at all uncommon for inexperienced workers to try hand-turning on large diameters, with the lathe turning at high speed. For small diameters speed is essential but it is better to use a slow speed till proficiency is gained, noting that the risk of chatter is absent under these conditions.

Those beginners who already know something of the correct angles to which slide-rest turning tools should be ground will have already perceived that the effect of holding the graver in the manner described is to produce considerable side and top rake on the tool, which is essential in cutting steel freely.

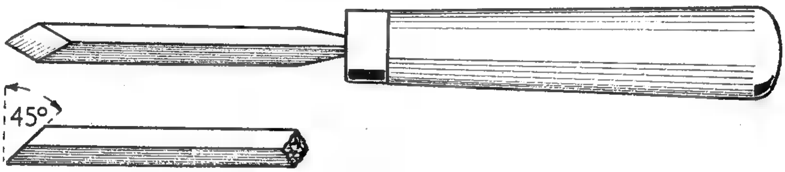


Fig. 1

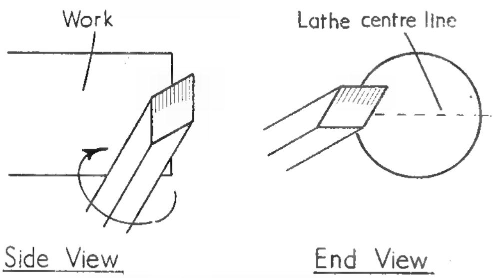


Fig. 2. *Position of graver when turning steel*

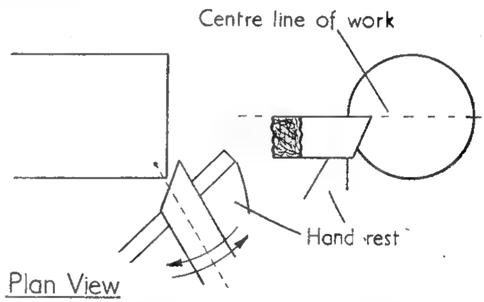


Fig. 3. *Position of graver when turning brass*

Brass needs neither side nor top rake, therefore some modification of the manner in which the graver approaches the work is necessary. The tool is laid on the hand rest, which has previously been set at some 45 deg. to the axis of the work and at a height which will bring the cutting edge of the graver exactly on the centre line; the tool has its edge presented at right angles to the work and is again held down to the rest by the thumb and first finger of the left hand.

The movement necessary to produce ■ rounded corner on the work is imparted by the right hand, which swings the graver to and fro on an imaginary centre as shown in Fig. 3.

Sharpening the Graver

It must be emphasised that sharpness is essential, for it is quite impossible to cut either cleanly or quickly with a graver that has lost its edge. Moreover, the finish of the work will be impaired. Full instructions for sharpening are given in "Sharpening Small Tools," published by Messrs. Percival Marshall & Co., but it will

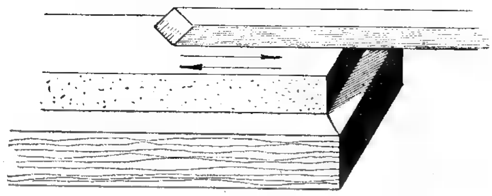


Fig. 4

have been seen from Fig. 1 that the point is ground at an angle of 45 deg. to the long axis of the tool.

It is practically impossible to grind a graver freehand, and it is best, therefore, to mount it in a vee-block on the angular grinding rest, so that, after the grinding rest has been tilted to the correct angle, the tool is presented to the face of the emery wheel in the proper manner.

Great care must be taken to ensure that the point does not become overheated during the grinding operation, or it will be softened, and the tool rendered unfit for further use until it is re-hardened and tempered.

After grinding, the graver should be carefully stoned to ensure that any wire edge is removed. This is best done by laying the graver on a fine oilstone in the manner depicted in Fig. 4, and working it backwards and forwards. The tool must be kept flat or the cutting edges will become rounded. The diamond-shaped facet ground on the tip of the tool needs very careful honing. As this is a somewhat difficult matter, jigs are sold for the purpose.

However, if care is taken, it is possible to dispense with the jig and hone the facet free-

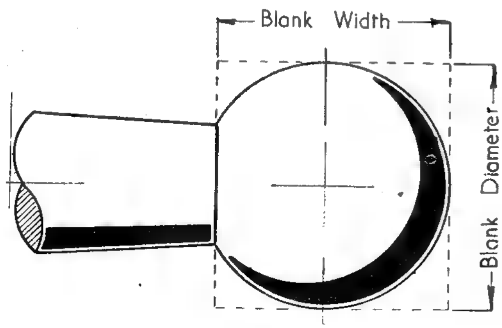


Fig. 5

hand by holding the graver at an angle to the oilstone in the manner of sharpening a chisel.

Turning Balls by Hand

After the novice has accustomed himself to the use of the graver for forming rounded corners, he will, no doubt, seek further work on which to test his skill in hand turning, and it will probably occur to him that the forming of balls such as those to be found on the handles of machine tools offers useful experience, for the balls in question do not need to be of very great accuracy, though there is a simple and rapid method of ensuring comparative roundness and uniformity of size which is dealt with later.

Setting Out the Blank for Turning the Ball

It will be clear that the diameter to which the blank must first be turned by means of slide-rest tools, is that of the finished ball plus a margin of 0.001 in. to 0.003 in. for final cleaning up. If the ball is a separate unit which is to be fixed to a lever, the length of the blank can well be made the same dimension as the finished diameter, for this will make the blank slightly over long which is a good fault as a little extra material is then left in hand. A piece of round mild-steel to form the blank is first drilled and tapped in the lathe, parted off, to length, and screwed to a true running stub mandrel for turning to the correct diameter

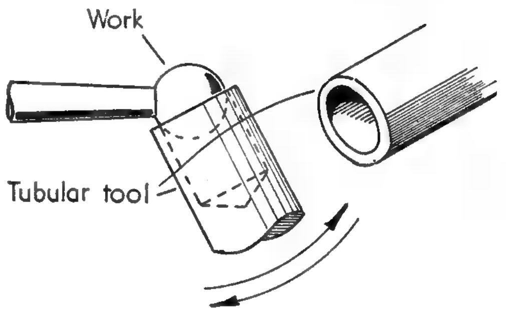


Fig. 6. Using a tubular tool to finish turned balls

prior to working upon it with the hand graver.

The case of balls which are formed integrally with the shaft of the lever, of which they form a part, is somewhat different as the length of the blank is dependent on a variety of conditions. It is best, therefore, to set out to an enlarged scale on the drawing board, the ball on its shaft, then, as seen in Fig. 5, the exact length of the ball blank can be readily determined.

In turning the ball, operations are carried on until the finished product presents a pleasing and uniform appearance to the eye, care being taken to see that neither the length nor the diameter of the blank is reduced in the process. The beginner will find that he must cultivate skill in using the graver both right and left handed ; this does not necessarily imply that he need be ambidextrous, it merely means that he will need to train himself in using the tool, with equal skill, on either side of a component.

A Method of Sizing Turned Balls

When a number of ball-ended components of the same size have to be made, it is essential that there should be uniformity in the diameter of the balls if the appearance of the model or mechanism of which they form a part is not to be spoilt. At first sight this would appear to be

anything but a simple matter. Fortunately, however, it is quite simple and, when working in brass, reasonably expeditious. All that is needed is a piece of silver-steel rod of sufficient diameter to allow a hole the same size as the finished ball to be drilled in it axially leaving a reasonable thickness of metal in the walls of the tubular tool thus formed. The tool is then hardened and tempered, fitted with a suitable handle, and, after grinding dead square with its axis, is applied to the work by swinging it round the ball, Fig. 6. The tool scrapes, rather than cuts, and it will be obvious that as soon as the ball has been reduced to the required size it will enter the hole in the tool, thus indicating that the ball is sized. This device is perfectly satisfactory for use on metal balls of small diameters, and for use on wood or plastic balls of much larger diameter. In the case of the latter the tool may conveniently be made from a length of mild-steel tube, which has its working end case-hardened, though in dealing with a single ball the cutting edge will probably last long enough if the steel is left unhardened.

Queries and Replies

Enquiries from readers, either on technical matters connected with model engineering, or referring to supplies or trade services, are dealt with in this department. Each letter must be accompanied by stamped, addressed envelope, and addressed: "Queries Dept." THE MODEL ENGINEER, 23, Great Queen Street, London, W.C.2.

Queries of a practical character, within the scope of this journal, and capable of being dealt with in a brief reply, will be answered free of charge.

More involved technical queries, requiring special investigation or research, will be dealt with according to their general interest to readers, possibly by a short explanatory article in an early issue. In some cases the letters may be published, inviting the assistance of other readers.

Where the technical information required involves the services of an outside specialist or consultant, a fee may be charged depending upon the time and trouble involved. The amount estimated will be quoted before dealing with the query.

Only one general subject can be dealt with in a single query; but subdivision of details into not more than five separate questions is permissable. In no case can purely hypothetical queries, such as examination questions, be considered within the scope of this service.

No. 9784—Vacuum Pump Readings
P.V.H. (Hathern)

Q.—Could you give me some information on measuring the c.f.m. in vacuum pumps. I wish to get the correct readings, and perhaps you could tell me if there is a gauge or some simple device on the market for this purpose.

R.—The amount of air or gas displaced by a vacuum pump will obviously vary according to the height of the vacuum produced, decreasing practically to zero at high vacua. Under the circumstances, it is extremely difficult to measure the amount of fluid displaced, but it could be done by the use of a Venturi meter, or other form of flow meter attached to the discharge side of the pump. We do not know of any simple form of gauge, giving direct readings of displacement of a nature suitable for this purpose.

No. 9797.—Compressor Supply for Spray Gun
F.G. (Darlington)

Q.—I would be very grateful if you could give me some information about the trouble I am having with a compressor I have made, which is, in some respects similar to that described in THE MODEL ENGINEER in May, 1937, except that the bore is $2\frac{3}{16}$ in. × $1\frac{7}{8}$ in. stroke. One of the troubles is that it pumps air from 0 to 60 lb. in about 60 sec., but above that (60 lb.) up to 100 lb. it takes about 7 min., although there is no V-belt slip, and there is no excessive heat on valves or head. Another trouble is that it will not keep the spray gun going for more than 30-40 seconds.

R.—The compressor you describe should be sufficiently large for the purpose of supplying a spray gun, but we notice that you do not give any particulars of the speed at which it is run, and we suggest that it would be advisable to run it at a speed of 700 to 800 r.p.m. to ensure sufficient output.

We note that you are using a disc-valve for the inlet and a ball-valve for the outlet, both of them spring-loaded. We suggest that the inlet-valve should not be spring-loaded, but its movement should be restricted to $\frac{1}{16}$ in. or less, and it should not restrict the passage when fully opened.

The ball-valve with spring-loading should be fairly satisfactory for delivery, but here again restriction of lift is often found desirable, and we suggest that the opening of $\frac{3}{16}$ in. is hardly adequate for a compressor of this displacement, unless more than one delivery valve is used.

There is a possibility that too much clearance has been left in the head of the compressor, which would account for the time taken in working up to a high pressure, but of course, the capacity of the air reservoir, about which no information is given, would also influence this.

In a compressor intended to work at high pressure the very minimum clearance should be allowed between the passage and the head at top dead centre.

No. 9772.—The Craftsman Twin
A.G.B. (Louth)

Q.—I have recently completed the construction of a Craftsman Twin 10-c.c. petrol engine, and think the first essential is to get a proper coil for the engine. Could you give the address of a firm that could supply me with a suitable condenser. Secondly, although I have fitted the flywheel, which is handy for starting, there is the problem of cooling, as well as that of providing some load for the engine to work against when running mounted on a wood block in the vice, and I think I should be better off with a propeller to start with. Could you give me a suitable size of airscrew and the name and address of a firm who could supply same.

I should appreciate your comments on starting and running the engine ; also, on suitable fuel and oil, and correct proportions.

So far as speed control is concerned, I found that I could only get the engine to start and run with the needle-valve about 1½-2 turns open and the strangler almost shut, the latter being opened up gradually to its maximum open position as the engine warmed up.

In addition to a few small defects, I noticed on cleaning-up that one of the plugs is defective in that the insulator is cracked within the body of the plug on the central electrode, and it is, therefore, possible that this plug was not doing its duty properly. Although the engine was firing on both cylinders, I noticed that one cylinder-head seemed to get hotter than the one with the defective plug, and had a rather " dry white " appearance.

R.—We agree that the selection of a really efficient coil for the engine referred to, or indeed any engine, is an important point, but I feel it is very difficult to recommend any of the commercial makes of coils, owing to the fact that most makers have concentrated on producing very small lightweight coils which are not as efficient as is really desirable for efficiency and reliability. The coil usually recommended for the Craftsman Twin is the M.I. Duomite, which is obtainable from most model shops, or from Craftsmanship Models Ltd., Norfolk Road Works, Ipswich.

The airscrew generally recommended for the Craftsman Twin is about 13 in. dia. by 6 in. to 9 in. pitch, but we do not know of any firms supplying a suitable propeller ready-made.

The fitting of the tank at a very slightly higher level than the jet is quite good practice, provided only that the engine is never allowed to flood by having the fuel turned on while it is standing. If this is done, there may be considerable starting difficulty due to flooding of the engine. The bowl type reservoir fitted below the jet is safer in this respect but not so well suited to running at high efficiency. The procedure you suggest of opening the needle-valve about 1½ to 2 turns, and almost closing the strangler is generally quite correct for this engine, as it has been found that it requires a fairly rich mixture for starting, but the air shutter should be opened and the jet opening reduced as soon as possible after starting.

The fuel which has been found most suitable for the engine in its standard condition is a mixture of ordinary pool petrol with 20 to 25 per cent. of a really good quality oil, such as Castrol XL or Essolube, but the engine will run fairly well on a wide variation of lubricating strength and also widely different fuels.

A cracked insulator in any sparking-plug is fatal to reliable running and the only remedy there, of course, is to replace the plug.

No. 9789.—Model Submarine.
A.F.W. (S. Norwood)

Q.—I have made a model submarine fitted with electric motor for driving, but would appreciate some information on how to make the model submerge.

R.—The usual method of causing a submarine to submerge is to fit ballast tanks, which may be opened to the entry of water and thereby enable the buoyancy of the vessel to be destroyed. In order to cause the submarine to rise again, it is necessary to pump out these tanks, and electrically-driven pumps are fitted to submarines for this purpose.

A similar method could be used in the model, employing some form of delayed-action gear, such as a time switch, to start the pumps after a suitable time of submersion.

A secondary method which is used to cause the submarine to dive quickly while under way, is the use of horizontal hydrofoils, equivalent to the elevators of an aeroplane. By altering the angle of incidence of these hydrofoils a force is exerted on them, tending to depress the vessel, but this method obviously cannot be used for long periods of submersion, and is, of course, inoperative when the propulsion motor is not running.

No. 9798.—Modified " Mini-Auto " Unit
R.J.E. (Sale)

Q.—I wish to build a modified form of the Ostler " Mini-Auto " to propel a bicycle and would appreciate assistance on two points.

(1) In an engine of this type, 25 c.c. two-stroke, is it in order to use a crankshaft of the " split flywheel " type ? This would help me to reduce engine overhang even if I had to use an external flywheel as well.

(2) Can I use a " butterfly throttle " for idling in an enlarged version of the " Atom Minor " carburettor ? Would it be better to use another type ?

R.—(1) A crankshaft incorporating internal flywheels is quite suitable for use in a 2-stroke engine, but it is generally necessary to keep the diameter of the flywheels relatively small to avoid excessive crankcase clearance. This would not be a great disadvantage if an external flywheel, as suggested, is used as well.

(2) The use of a butterfly throttle as a suitable design of carburettor is quite in order. As you are probably aware, some types of motor cycle carburettors are now fitted with butterfly throttles. The older type of plunger throttle is really a relic of early carburettor development. A compensated jet-type of carburettor such as the " Atom type R " or " Mark III " would be quite suitable.

PRACTICAL LETTERS

Efficiency of Small Locomotives

DEAR SIR,—In reply to Mr. C. H. Roberts, I would first point out that although he claims in his letter (THE MODEL ENGINEER Dec. 8th), that his method measures the work done by an engine compared with the fuel consumption, his original formula contains terms which are not compatible with this claim. If you agree with him that a broader article on my own views on the meaning of efficiency might be of interest, I am prepared to produce one ; but, in connection with small locomotives, it seems unnecessary to deviate from the strictly orthodox. The efficiency of any heat engine is the ratio of the total work obtained to the total heat put into the engine. The work done by a locomotive is given by multiplying the force exerted on the load by the distance through which the point of application of the force is moved. The total heat input is given by the fuel consumption multiplied by its calorific value. The work done and the heat input must be measured in the same units and the conversion factor is : one B.Th.U. equals 778 ft. lb. (This is " putting B.Th.U. in terms of work ")

Efficiency ?

I had no intention of criticising Mr. Roberts' article in general, but objected only to his misuse of the word efficiency. However, very properly, he challenges me to say how I would set about measuring locomotive efficiency, and here very briefly are my proposals :

First, the test should be arranged so that the state of the locomotive is the same at the beginning and end of the test run especially steam pressure, water level and the fire, and the duration of the test should be great enough to make slight variations in these insignificant.

The measurement of the heat input is done by weighing the fuel stock before and after the test, giving the weight consumed by difference and then determining the calorific value of the fuel. For our purposes the latter may be taken from tables giving average values e.g., Anthracite at 15,000 B.Th.U. per lb.

Measuring the work done is a more difficult task. The best method is the use of a test stand. The general principles of this was last described in mid 1948, by Mr. Westbury in articles on " Petrol Engine Topics." Using a stand permits tests to be carried out over a range of speeds and loads ; more care can be taken over stoking, etc., and most important of all, other measurements can be taken to discover where improvements are indicated.

Draw-bar Pull

Alternatively, one might measure continuously the draw-bar pull during a track run. The track introduces some losses due to its own imperfections, but all the other schemes for testing on a track have overlooked these, and I feel they may be legitimately charged with the other mechanical imperfections. Two ways of doing this are suggested, and both depend on measuring the pull by the extension of a suitably damped spring. This extension may be transmitted by a light system of levers to move a pen of the recording instrument pattern across the width of a roll of paper which is moved lengthways by the motion of the truck. Squared paper should be used, each square side across the paper would represent a force of so many pounds (checked by dead weight measurement) and each square side lengthways would represent so many feet. Thus, if a pull of 1 lb. gives a deflection of three square sides, and distance of 1 ft. is equivalent to four sides lengthways, then each square area under the curve traced during the test will correspond to one twelfth of a ft./lb. work.

An Integrating Device

The second way involves the use of a simple integrating device which, in effect, does the job of counting the squares and records the answer on a rev counter. An infinitely variable friction drive would form an adequate integrator. A friction plate is driven positively from an axle of the truck and each revolution of this corresponds to a definite distance moved. The driven wheel of the gear is free to slide on a splined shaft across the face of the friction plate. The position of the sliding member is controlled by the extension of the spring measuring the pull ; when this spring is not loaded then the driven wheel should be at the centre of the plate, and the splined shaft not revolve when the truck axle is rotated. The rev counter is driven directly from the splined shaft, and as it is the only load carried by the friction drive, slipping should not cause inaccuracy. Calibration is achieved by applying a load of 1 lb. weight to the spring, and moving the truck forward 1 ft. The number of revolutions counted will then correspond to 1 ft./lb. work.

The efficiency is then given as a percentage by the formula :—

$$\frac{\text{Work done (ft./lb.)} \times 100}{\text{Fuel weight (lb.)} \times \text{Calorific Value (B.Th.U. per lb.)} \times 778 \text{ (ft./lb. per B.Th.U.)}}$$

It will be observed that scale does not enter into any of the foregoing. This is because efficiency is a ratio having no dimensions of length, time, weight, etc., and the principles and modifications of the test methods apply regardless of the size of the locomotive and in fact regardless of the type of heat engine whether it be a minute c.i. engine, the engines of the *Queen Mary* or looking ahead, a nuclear fission-fired closed circuit gas turbine.

One final word of warning, if the test shows only 4 per cent. efficiency remember this is *twice* as efficient as the other man's engine giving only 2 per cent., and about half as efficient as full size practice.

Yours faithfully,

Warrington. W. H. NIGHTINGALE.

Automatic Cut-out

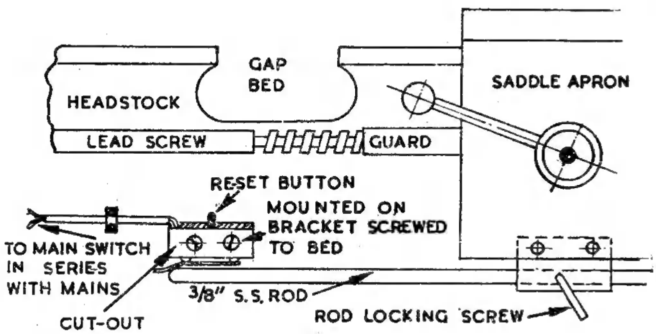
DEAR SIR,—I fear that many "M.E." readers will be disappointed if they decide to make the automatic cut-out described by Mr. Turpin in the issue of November 17th, 1949. I made a similar arrangement some twelve months ago but had to modify it for three reasons, two serious and one possibly so, at least to the work in hand.

First, the trailing lead to the cut-out carries full mains voltage, runs right across the working parts of the lathe, and soon becomes chafed, with resulting fireworks and possible risk of shock.

Secondly, if the operator forgets only once, that the cut-out is set, and operates the saddle manually, the bakelite moulded switch has "had it."

Thirdly, unless the operator remembers to switch off the main switch after the cut-out has operated, the motor will start again as soon as the saddle is moved. This is rather alarming the first time it occurs.

The first and second points can be overcome by adopting a much simpler arrangement, which



obviates the necessity for a bar running the length of the lathe, as per sketch. It will be seen that the wiring and switch are permanently fixed out of harm's way, and in addition manual overtravel will not damage the switch.

The third disadvantage is cured by using a switch of the "re-set" type which Mr. Turpin omits to mention; this is surprising as the sketches in Fig. 2 appear to be copied from the Burgess Company's leaflet.

Yours faithfully,
Chilworth. H. C. MILLINGTON

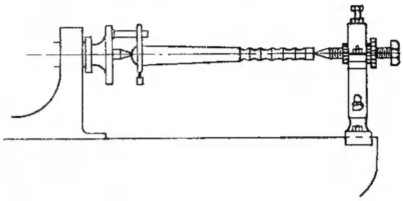
Turning a Truncheon

DEAR SIR,—When I joined the Rhodesian Police Reserve, they had run out of truncheons and were issuing sawn-off pick-handles.

This did not suit me, so, having secured a length of hard Rhodesian teak and borrowing a truncheon as a pattern, I decided to turn my own, on my small 3-in. lathe.

As the length of a police truncheon is just over 15 in., and my lathe would take only 12 in. between centres, I took off the tailstock and secured the lathe steady as far back as it would go.

Then, centring a short length of drilled and tapped rod (½ in. tapped) in the lathe steady, I screwed into it a ½-in. set-screw which had



previously been turned to 60 deg. at one end, to form a centre.

The job then presented no difficulties; though the taper had to be done by hand-tools.

A check-nut was necessary at the back-end of the set-screw to stop it revolving.

Yours faithfully,
Bulawayo. W. E. LANSDOWN.

An Old Mill Engine

DEAR SIR,—On a recent visit to a cotton mill in Barnford I saw a steam engine that might interest model engineers in this area.

I was not allowed into the engine room, but it is a large compound engine with a fly-wheel about 20 ft. in diameter, the drive being taken from this flywheel through about six ropes at a very high speed.

I forget the maker's name, but they went out of business some years ago.

Anyway, I would like to hear more about it, so I hope someone will be able to obtain further information, and report it in some future issue of "Ours."

Yours faithfully,
Sheffield. R. LEACH.

Automatic Traversing Gear

DEAR SIR,—Happening to read Mr. Dyer's letter *re* rack/hand traverse, I heartily agree; for all short traverses and reasonable cuts "use the saddle," provided this is the geared-down variety, not one turn for 1¼ in. travel, as some have!

The main point is to use the rim of hand wheel, passing same from right-hand to left-hand to keep cut going, *not* just one hand on the handle! Like Mr. Dyer, this habit was acquired all of 40 years ago on lathes from 10 in. to 6 in. centre mostly. I would like to call attention to an excellent little book by Mr. Dyer dealing with a host of "semi-impossible" jobs, remetalling bearings and so on.

Yours faithfully,
Chelmsford. G. BERKELEY.